Appendix J

PLAN PERFORMANCE

May, 2001

2001 RTP Technical Appendix

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Plan Performance

Introduction

The Southern California Association of Governments (SCAG) has developed a methodology to assess planning, policy and programming decision making from a technical standpoint using performance indicators. The performance indicators are designed to be an objective decision making tool which take into consideration broad community concerns such as transportation, economic well being, environmental quality, and quality of life in general and translate them into quantifiable and measurable criteria such as mobility, accessibility, environment, cost-effectiveness, reliability, safety, consumer satisfaction and equity. In using performance indicators, it is inherently necessary that the problems be tackled in a systematic and organized manner, so as to prioritize the projects and programs that are most cost effective in addressing regional transportation problems.

The 1998 Regional Transportation Plan (RTP) was the first plan in which SCAG used performance indicators. A key benefit of applying the performance indicators in developing the 1998 RTP was the use of cost-effectiveness analysis in the initial prioritization of the potential projects for inclusion in the plan. Furthermore, performance indicators lend themselves readily to the visual representation of analysis results compared to other traditional analysis tools. Consequently, it is possible to present the effectiveness of various transportation investment options visually utilizing maps, graphs, charts and figures to aid decision makers in leading to judicious final decisions.

One area where the concept of performance indicators may be extended would be in the arena of policy choices and decisions. For example, the region is just beginning to ask the difficult question "Can we afford to continue spending 60% of our transportation resources on a mode, namely transit, that carries only 2% of the total regional trips?" From a purely performance standpoint, it may be useful to present the level of subsidy to each mode expressed in terms of passenger miles traveled. While such a performance evaluation of auto and transit modes clearly portrays auto as the superior mode, there are other fundamental issues that must be addressed in making policy decisions. As with all good information, it must be used judiciously and in full context of our social, legal and economic system in arriving at critical policy decisions.

Goals of Performance Indicators

There are five major goals in adopting a performance-based approach in the transportation planning process. They are:

1. To integrate transportation policies with regional development concerns such as quality of life, economic competitiveness, and environmental concerns
2. To improve long range investment decisions to serve transportation needs for individuals and the region
3. To help decision makers formulate investment decisions of public and private funds
4. To serve as a quantitative link between transportation and policy concerns in the RTP
5. To examine system performance while taking into account performance of individual components of the system

Performance indicators are critical elements of a performance-based planning process because they determine what type of information is fed back into the investment decision making process and ultimately relate to how successful system performance is defined. Some of the advantages of a performance-based approach over the traditional approach include the following.

ü A performance-based approach better integrates transportation goals and policies with larger community objectives such as environmental concerns, quality of life and economic competitiveness.

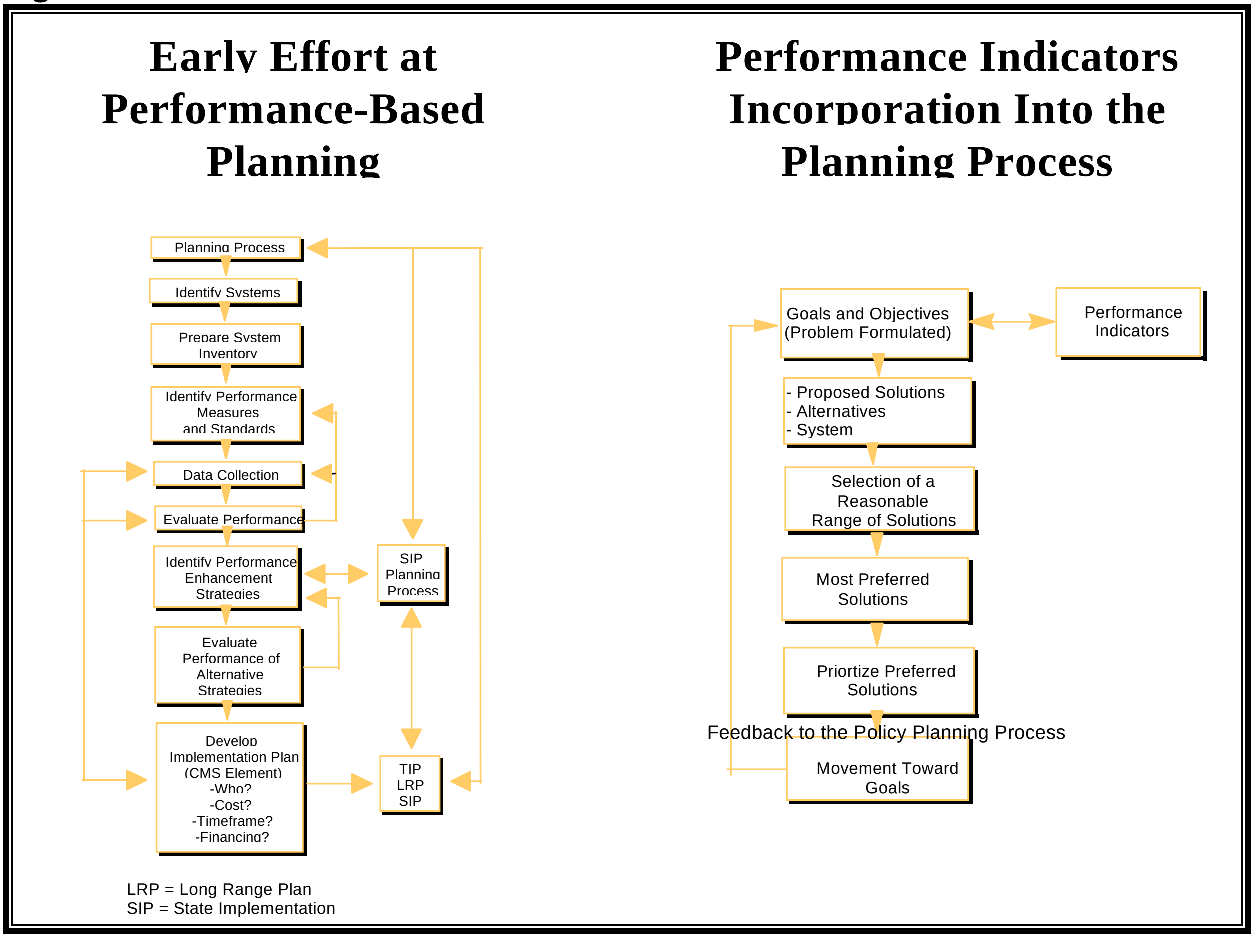
ü The new approach provides a more inclusive planning process that allows input from a wider range of agencies, organizations, and individual stakeholders within the region.

ü A performance-based approach helps foster decisions that reflect better planning through a better understanding of the problems, and leads to more cost-effective investments.

Where does Performance Analysis fit in the Planning Process?

The flow charts (Figure J.1) below depict how performance analysis is incorporated into the planning process. Earlier efforts at integrating performance into the planning process simply adapted the method to meet ISTEA requirements for a feedback process between planning and implementation (see flow chart on the left). Planning was still approached as a system issue with no explicit linkage between transportation performance and broader societal impacts. A better approach is to incorporate performance analysis into the planning process at several levels as depicted in the flow chart on the right. The analysis should be conducted at every phase of the planning process and provide feedback to initial goals and objectives that drive the transportation policies. This will ensure that projects and programs identified in the plan are in concert with the goals and objectives and support the implementation of policies.

Figure J.1



Basic Principles for Performance Indicators

The following are some of the basic principles that must be followed in developing a performance indicator.

- ü It must be simple and easily understood equally by decision-makers as well as individual stakeholders.
- ü There must be a clear understanding of the objectives of a performance measure. There is no room for ambiguity.
- ü It must be uniformly applicable across various transportation modes.
- ü It must be applicable across time and between geographic areas.
- ü It must reflect a broad array of impacts of transportation choices.
- ü It must be applicable to projects, programs and plans.
- ü It must be based on readily available data.

- ü It must relate to the planning factors identified in TEA-21, which requires consideration of broad themes: mobility and access for people and goods; system performance and preservation; and environment and quality of life.

2001 RTP Performance Indicators

While the basic approach in the application of performance indicators to the 2001 RTP is not significantly different from the 1998 RTP, it is generally more refined, with an emphasis on building consensus. SCAG's performance indicators were developed with the help of the public, stakeholders, subregions, County Transportation Commissions and several SCAG committees, including a Peer Review Committee and SCAG's Transportation and Communications Committee (TCC), which approved the performance indicators at its regular meeting in September 1995. The performance indicators used in the 1998 RTP focus on the ease of movement of people and goods.

- ü **Mobility** – ease with which individuals can move about
- ü **Accessibility** – access to opportunities
- ü **Environment –** sustainable development and preservation of the existing system and the environment
- ü **Cost-effectiveness** – maximized return on investment
- ü **Reliability –** system reliability
- ü **Safety –** transportation system should provide minimal accident, death and injury

At the request of SCAG's TCC, and on the basis of early subregional input, the 1998 RTP also provided analysis on transportation equity issues. In doing so, the 1998 RTP considered the impact of transportation policies that treat the automobile as one of many travel options available, as opposed to the only option. Since the 1998 RTP was adopted, the Regional Transportation Plan Technical Advisory Committee (RTP TAC) has reviewed the performance measures at great length. RTP TAC concluded that most of the assumptions, criteria and methodology used in the 1998 RTP were valid and should be applied in the new plan update as well. However, they could not resolve the issues of several of criteria, including Livable Communities, Geographic Equity and the issue of Transportation Sustainability.

A number of issues were raised in regards to the livable community concept. First, a consensus could not be developed on the definition of a livable community. The idea of livable community cannot remain all things to everybody if it is to be developed as a performance measure. The beauty of performance measures is that they force planners, decision-makers, implementers as well as end users equally to think precisely and develop more specificity to a concept. Furthermore, it is apparent that much of livable community strategies would involve implementation of land use policies that can not be addressed by a transportation plan alone. The impact of livable community strategies would be local rather than regional, so the effectiveness of such strategies would have to be measured at a local level to detect discernable impacts.

While the TAC found it difficult to both define and measure a livable community, it encountered a different problem with geographic equity. As a performance indicator, geographic equity is a difficult issue to tackle with politically. It is fairly straightforward to quantitatively evaluate the geographic distribution of benefit and costs. However, to some it may imply a potential redistribution of funding between various sub-regions within the SCAG region, which is a sensitive political issue.

Finally, the TAC was able to agree on a definition of transportation sustainability, but there were unresolved issues relating to its measurement. A sustainable transportation system meets the mobility and accessibility needs of society while balancing the current and long term goals of economic growth, environmental quality, and social equity without compromising the needs of future generations. It involves making sure we pass on a decent transportation system to future generations, and that we make transportation investment choices now that would meet our needs without compromising the ability of future generations to address their own issues. However, a consensus could not be reached on the appropriate criteria to measure and evaluate sustainability.

For future regional transportation plans, SCAG will continue to work on refining these three measures, as well as evaluating and improving all of its performance indicators.

Table J.1

Objective	Performance Indicator	Target
Mobility *Transportation System should meet the public need for improved access and for safe, comfortable, convenient, faster and economical movement of people and goods*	*Avg. Work Trip Travel Time in Minutes* *PM Peak Freeway Travel Speed* *PM Peak Non-Freeway Travel Speed* *Percent of PM Pk Travel in Delay (Fwy)* *Percent of PM Pk Travel in Delay (Non-Fwy)*	*25 minutes (auto)* *45 minutes (transit)*
Accessibility *Transportation system should ensure the ease with which opportunities are reached. Transportation and land use measures should be employed to ensure minimal time and cost.*	*Work opportunities within 45 minutes of door to door travel time (mode neutral)* *Average transit access time*	
Environment *Transportation system should sustain the development and preservation of the existing system and the environment (all trips).*	*CO* *ROG* *NOx* *PM10* *PM2.5*	*Meet the applicable SIP Emission Budget And the transportation Conformity requirements*
Reliability *Transportation system should have reasonable and dependable levels of service by mode (all trips)*	*Transit* *Highway*	*63% on-time arrivals* *76% on-time arrivals*
Safety *Transportation system should provide minimal accident, death and injury (all trips)*	*Fatal Per Million Passenger Miles* *Injury Accidents*	*0* *0*
Livable Communities *Growth Visioning Subcommittee has been initiated to further Articulate and evaluate growth, land use and livable communities strategies for inclusion in the next RTP update.*		
Equity/Environmental Justice *The benefit of transportation investments should be equitably distributed among all ethnic, age, and income groups (all trips).*	*By Income Groups Share of Net Benefits*	*Equitable distribution of benefits among all income quintiles.*
Geographic Equity *Work is continuing in further refining the issue and evaluation methodology. It will be considered for inclusion in the next RTP Update*	*Expenditures vs. Benefits*	*Equitable distribution of benefits.*
Cost-Effectiveness *Maximize return on transportation investment (all trips)* - *Air Quality* - *Mobility* - *Accessibility* - *Safety*	*Return on Total Investment*	*Optimize return on transportation investments*
Transportation Sustainability *Work is continuing in further refining the issue and evaluation methodology. It will be considered for inclusion in the next RTP Update.*		

2001 RTP Performance

The primary tool used in assessing the performance of the 2001 RTP is SCAG’s enhanced regional transportation demand model. A complete description of this model and associated model validation and calibration process is provided in a separate report called the *1997 Model Validation and Summary*.

Definition of Baseline

For analysis purposes, the 2001 RTP Baseline represents the existing transportation system plus committed projects that the region can reasonably be expected to build in the near future. This includes all ongoing travel demand management (TDM) or transportation system management (TSM) activities. Additional planned projects and programs on top of the Baseline, together with the Baseline, constitute the entire RTP. The performance of the RTP is measured against the performance of the Baseline to indicate the benefits (and costs) the region may face with the new investments contained in the RTP.

Specifically, the Baseline is composed of the existing, regionally significant transportation system plus projects in the adopted 2000 Regional Transportation Improvement Program (RTIP) that have any funding for construction or right-of-way acquisition. Additional projects identified by the County Transportation Commissions as TEA-21 High Priority projects, 2000 STIP projects, and projects in the Governor’s Traffic Congestion Relief Plan (TCRP) are also included in the Baseline. In general, the majority of TEA-21, STIP, and TCRP projects are already programmed in the 2000 RTIP. This definition of Baseline was developed under the guidance of the RTP Technical Advisory Committee.

For modeling transportation conformity with air quality requirements, SCAG utilized a different definition of Baseline based upon the Environmental Protection Agency’s Transportation Conformity Rule. EPA's Transportation Conformity Rule defines the Baseline scenario as the future transportation system that will result from current programs, including:

1. All in-place regionally significant highway and transit facilities, services and activities
2. All ongoing travel demand management (TDM) or transportation system management (TSM) activities
3. Completion of all regionally significant projects, regardless of funding source, which are currently under construction, or undergoing right-of-way acquisition; come from the first year of the previously conforming regional transportation plan (RTP) or transportation improvement program (TIP); or have completed the National Environmental Policy Act (NEPA) process.

With respect to this definition, the conformity Baseline consists of the existing regionally significant transportation system plus projects from the adopted 2000 RTIP that meet the above outlined criteria. These projects are also known as the “No-Build” portion of the RTIP.

Summary Statistics

The following tables and charts provide a summary of model output results at the regional level, which provides the basis for the performance assessment of the plan.

Table J.2

Summary of Model Output					
	1997 Base Year	**2010 Baseline**	**2010 Plan**	**2025 Baseline**	**2025 Plan**
Vehicle Miles Traveled (VMT)					
Light and Medium Duty Vehicles	324,036,742	386,240,799	381,943,048	463,222,112	452,298,566
Heavy Duty Trucks	22,256,122	30,132,639	30,158,794	37,783,337	37,777,503
All Vehicles and Trucks	346,292,864	416,373,438	412,101,842	501,005,449	490,076,069
Vehicle Hours Traveled (VHT)					
Light and Medium Duty Vehicles	8,570,813	11,200,981	10,692,814	15,322,564	13,791,414
Heavy Duty Trucks	492,573	723,882	698,469	1,036,230	952,334
All Vehicles and Trucks	9,063,386	11,924,863	11,391,283	16,358,794	14,743,748
Vehicle Hours Delayed					
Light and Medium Duty Vehicles	1,531,222	2,336,378	1,991,713	4,531,597	3,352,223
Heavy Duty Trucks	81,161	156,650	133,504	323,706	245,043
All Vehicles and Trucks	1,612,383	2,493,028	2,125,217	4,855,303	3,597,266
Total Person Trips					
Los Angeles County	31,432,767	35,339,907	34,873,826	40,310,676	39,406,082
Orange County	10,323,263	11,831,650	11,797,578	12,859,743	12,800,777
Riverside County	4,511,930	6,676,578	6,675,180	9,279,848	9,283,706
San Bernardino County	5,285,339	6,813,268	6,792,322	9,067,963	9,082,595
Ventura County	2,669,754	3,098,973	3,085,732	3,581,604	3,541,659
Total	54,223,053	63,760,376	63,224,638	75,099,834	74,114,819
Total Person Trips by Trip type					
Home Base Work	8,420,148	10,462,018	10,355,593	11,570,721	11,451,196
Home Base University	1,284,867	1,829,618	1,829,615	2,517,724	2,517,725
Home Base School	4,452,298	5,182,506	5,182,513	6,071,672	6,071,669
Home Base Other	21,566,248	24,789,375	24,577,306	29,580,424	29,158,108
Other Base Other	12,575,991	14,416,087	14,199,053	17,223,768	16,780,630
Work Base Other	5,923,501	7,080,772	7,080,558	8,135,525	8,135,491
Total	54,223,053	63,760,376	63,224,638	75,099,834	74,114,819

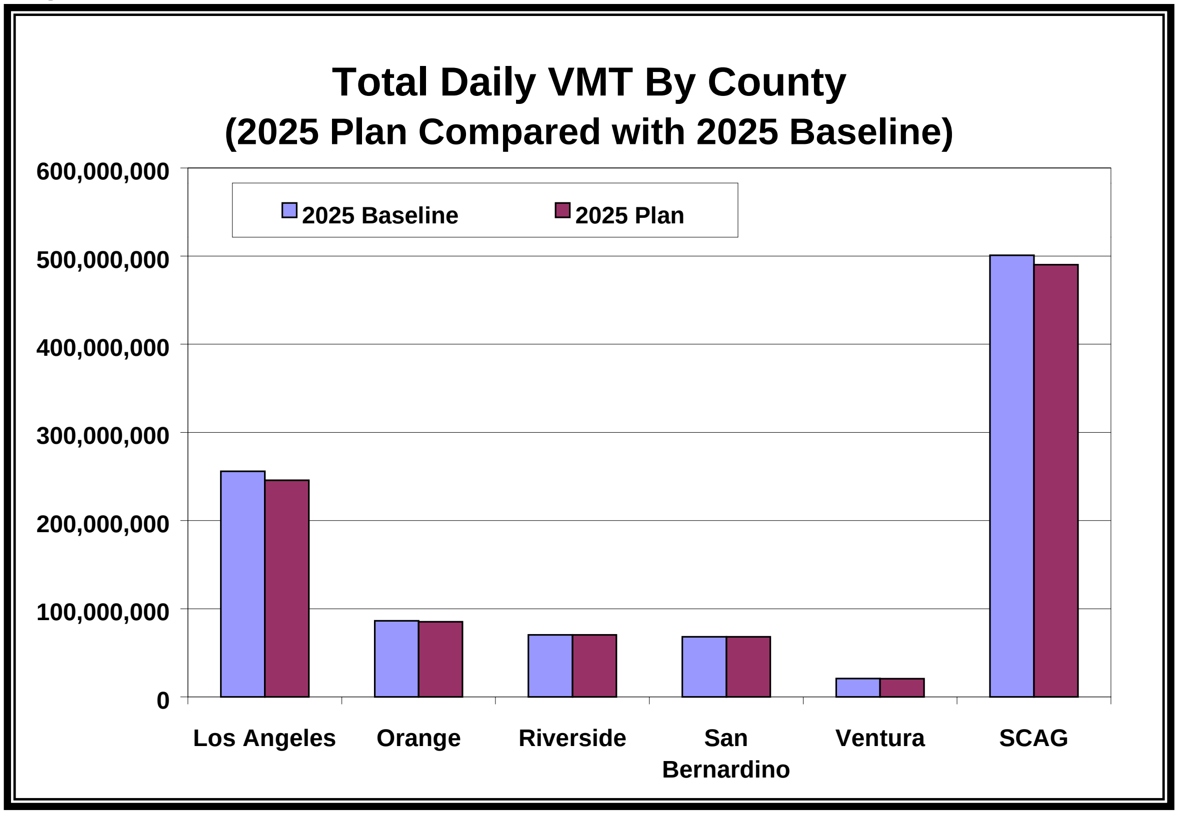
Summary of Model Output (continued)					
	1997 Base Year	**2010 Baseline**	**2010 Plan**	**2025 Baseline**	**2025 Plan**
Home To Work/University Mode Choice					
Drive Alone	7,344,249	9,137,462	8,910,422	10,499,743	10,117,780
% Person Trips	75.7%	74.3%	73.1%	74.5%	72.4%
Carpool	1,465,782	1,898,117	1,880,134	2,186,251	2,148,556
% Person Trips	15.1%	15.4%	15.4%	15.5%	15.4%
Transit	368,383	610,545	767,949	635,508	964,169
% Person Trips	3.8%	5.0%	6.3%	4.5%	6.9%
Non-Motorized	526,601	645,512	626,703	766,943	738,417
% Person Trips	5.4%	5.3%	5.1%	5.4%	5.3%
Home-Work Vehicle Person	8,810,030	11,035,579	10,790,555	12,685,994	12,266,335
Home-Work Vehicle Driver	7,952,994	9,918,589	9,684,007	11,398,146	11,000,542
Average Vehicle Occupancy	1.1078	1.1126	1.1143	1.113	1.115
Total Person Trips Mode Choice					
Drive Alone	25,396,307	30,438,229	29,869,732	36,120,265	35,085,300
% Person Trips	46.8%	47.7%	47.2%	48.1%	47.3%
Carpool	22,119,863	25,968,677	25,719,240	30,645,806	30,131,072
% Person Trips	40.8%	40.7%	40.7%	40.8%	40.7%
Transit	1,022,994	1,371,017	1,701,569	1,471,743	2,123,759
% Person Trips	1.9%	2.2%	2.7%	2.0%	2.9%
School Bus	599,481	710,050	717,887	814,905	829,456
% Person Trips	1.1%	1.1%	1.1%	1.1%	1.1%
Non Motorized	5,084,408	5,272,403	5,216,211	6,047,115	5,945,232
% Person Trips	9.4%	8.3%	8.3%	8.1%	8.0%
Total Vehicle Persons	47,516,170	56,406,906	55,588,972	66,766,071	65,216,372
Total Vehicle Driver	33,415,971	39,677,628	39,041,272	47,011,350	45,838,700
Average Vehicle Occupancy	1.4220	1.4216	1.4239	1.4202	1.4227
Average Trip Length (miles)					
Home-To-Work Trips	12.7	11.9	12.2	11.7	12.2
All Trip Types	7.8	7.8	7.9	7.8	7.9

Table J.3

TDM Assumptions					
	1997	**2010 Baseline**	**2010 Plan**	**2025 Baseline**	**2025 Plan**
Work at Home + Telecommute (H-W Trips)[1]	6.32%	6.93%	7.93%	9.32%	10.32%
Smart Shuttle (H-W Trips)	0.00%	0.00%	0.00%	0.00%	0.00%
Non-motorized[2]	9.38%	8.27%	8.25%	8.05%	8.02%
Vanpool[3]	0.00%	0.00%	0.80%	0.00%	0.80%
Jitney[4]	0.00%	0.00%	0.20%	0.00%	0.20%

[1] The estimation for work at home and telecommute trips in 1997 are based on Bureau of Labor Statistics, May 1997, Current Population Survey. Figures represent the percent of Home to Work person trips.
[2] Non-motorized rates are based on model output. Figures represent the percent of all person trips.
[3] 12-person vanpool capacity is assumed with an average 80% occupancy rate. Figures represent the percent of all person trips.
[4] Vehicle trips associated with jitneys are assumed zero. Figures represent the percent of all person trips.

Figure J.2



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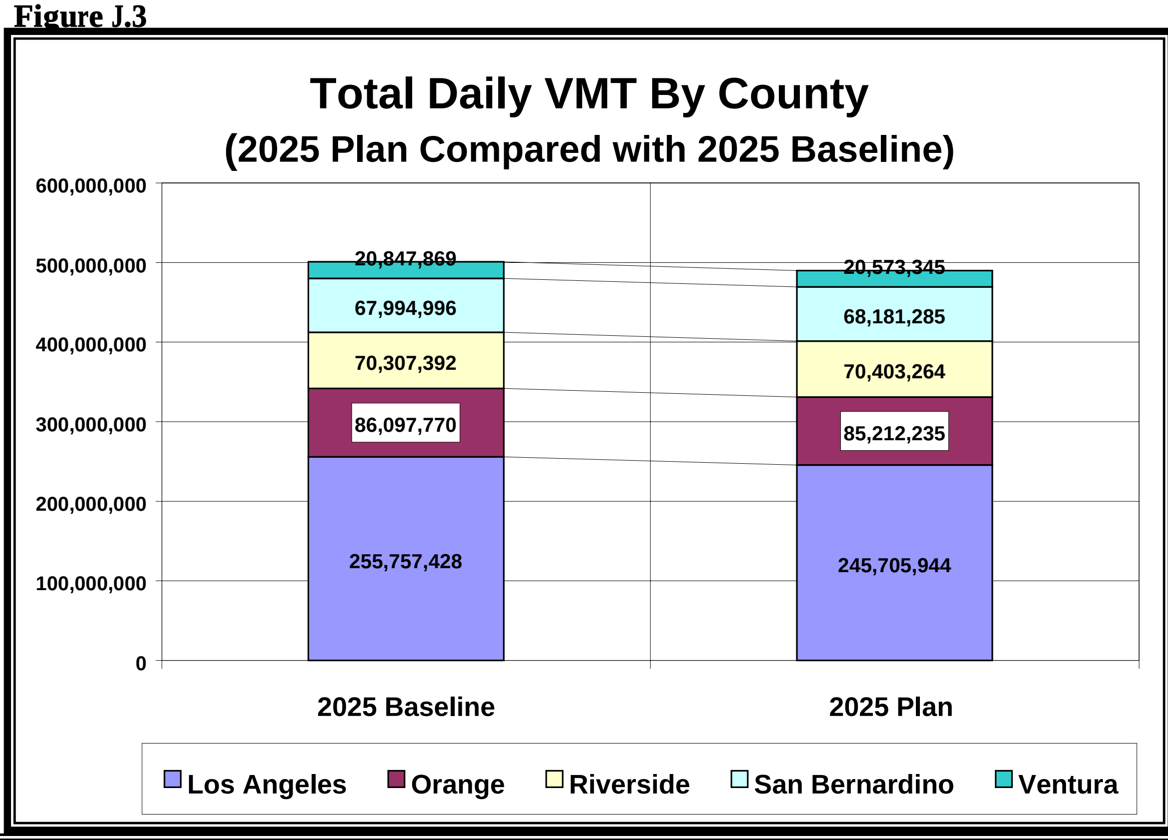

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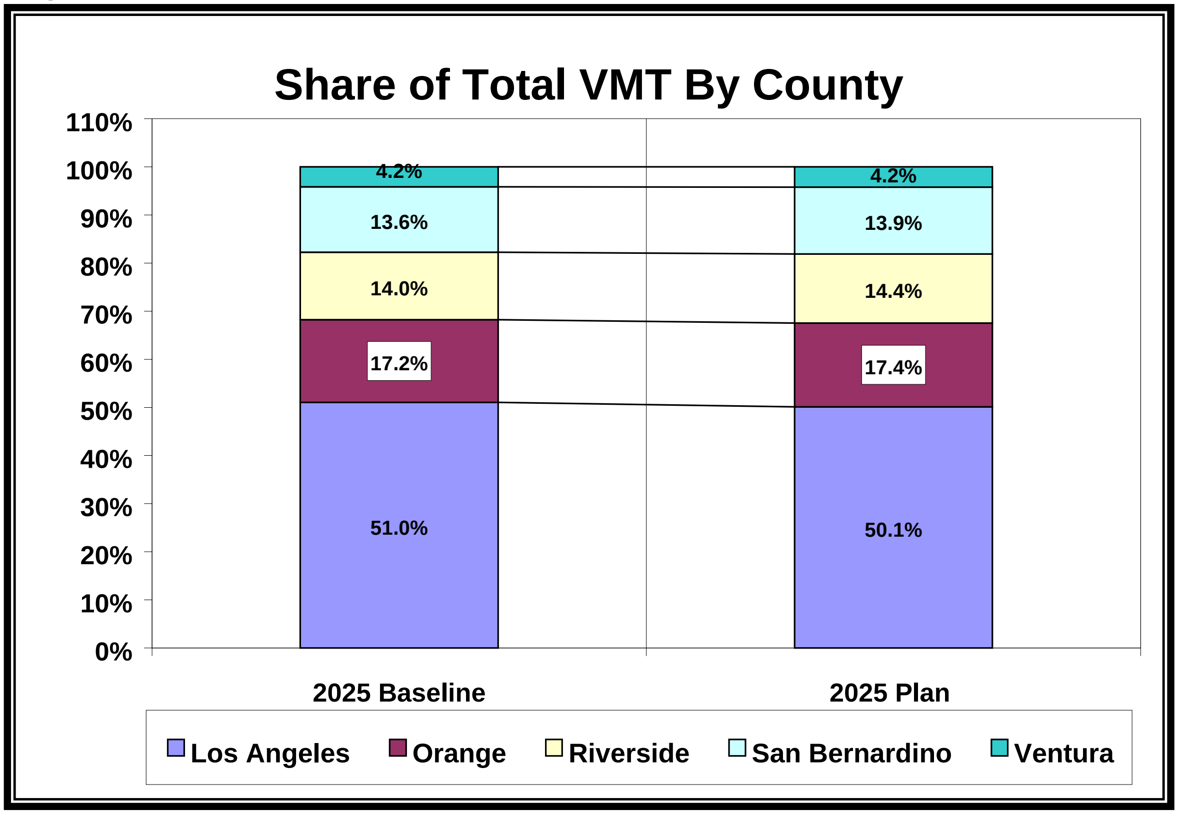

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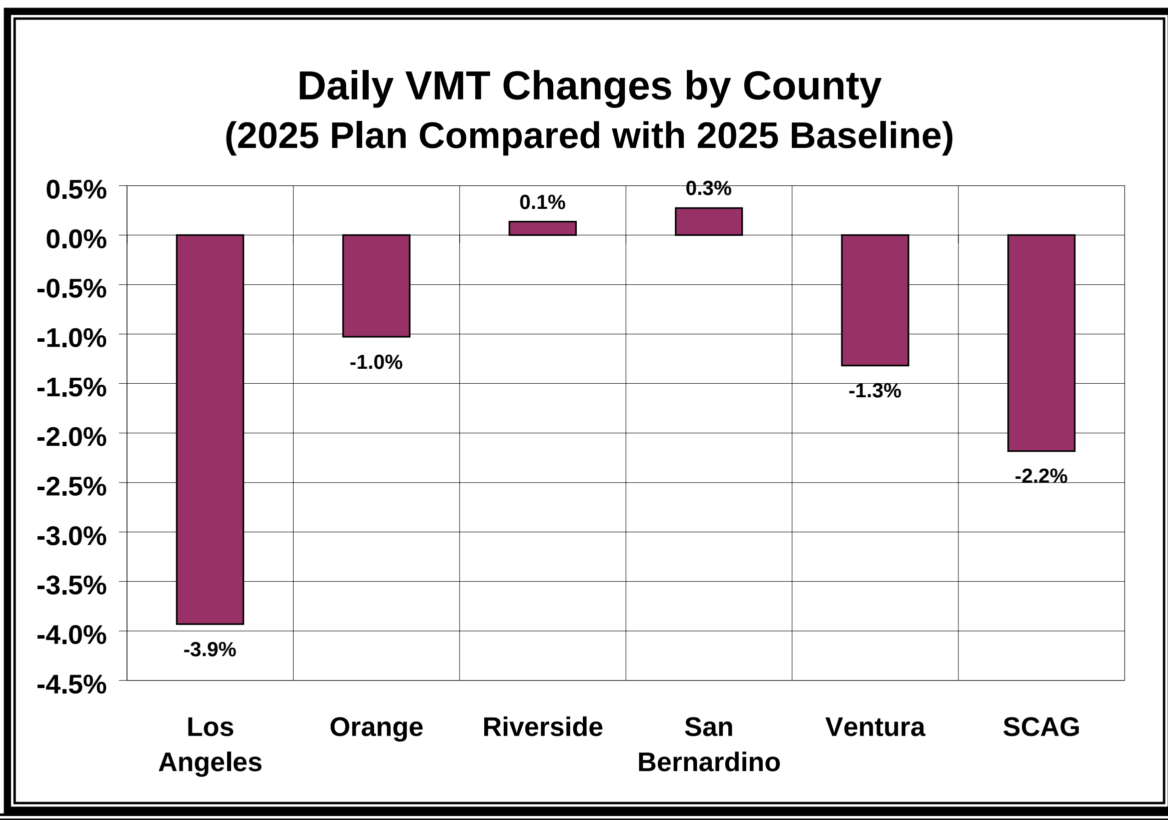

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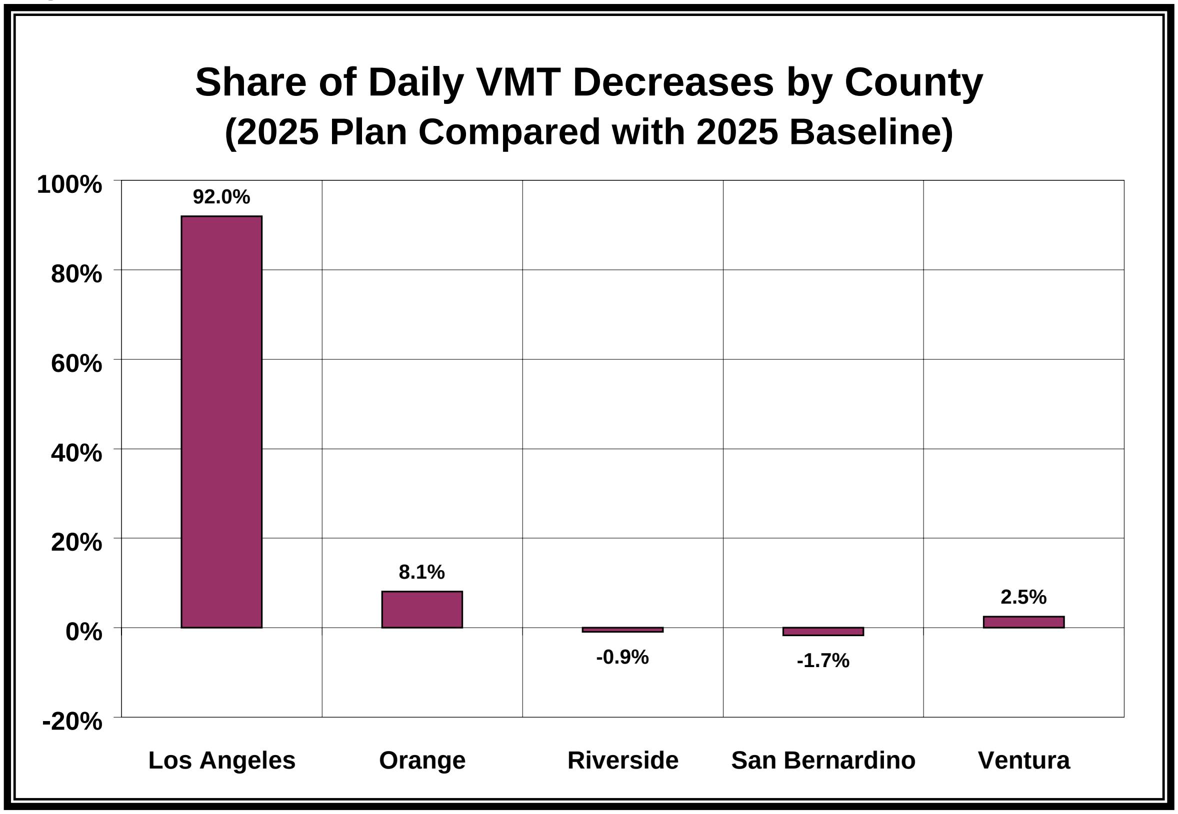

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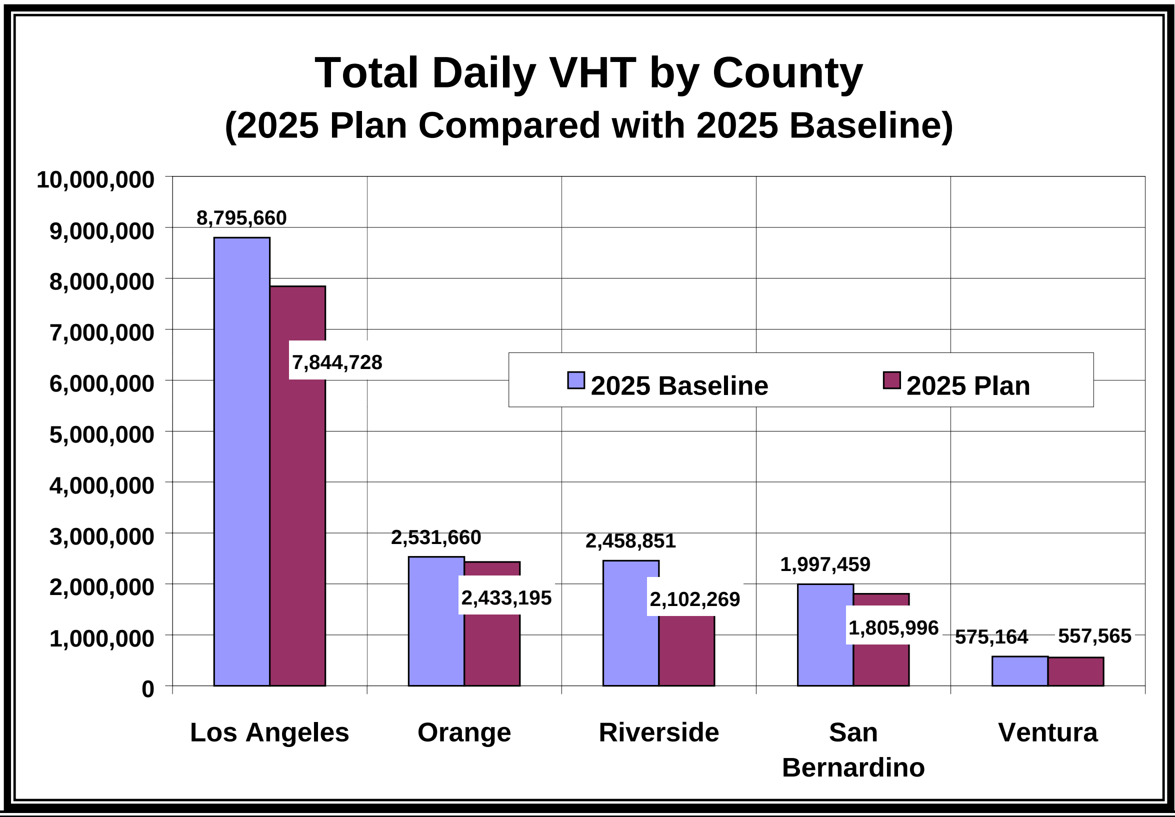

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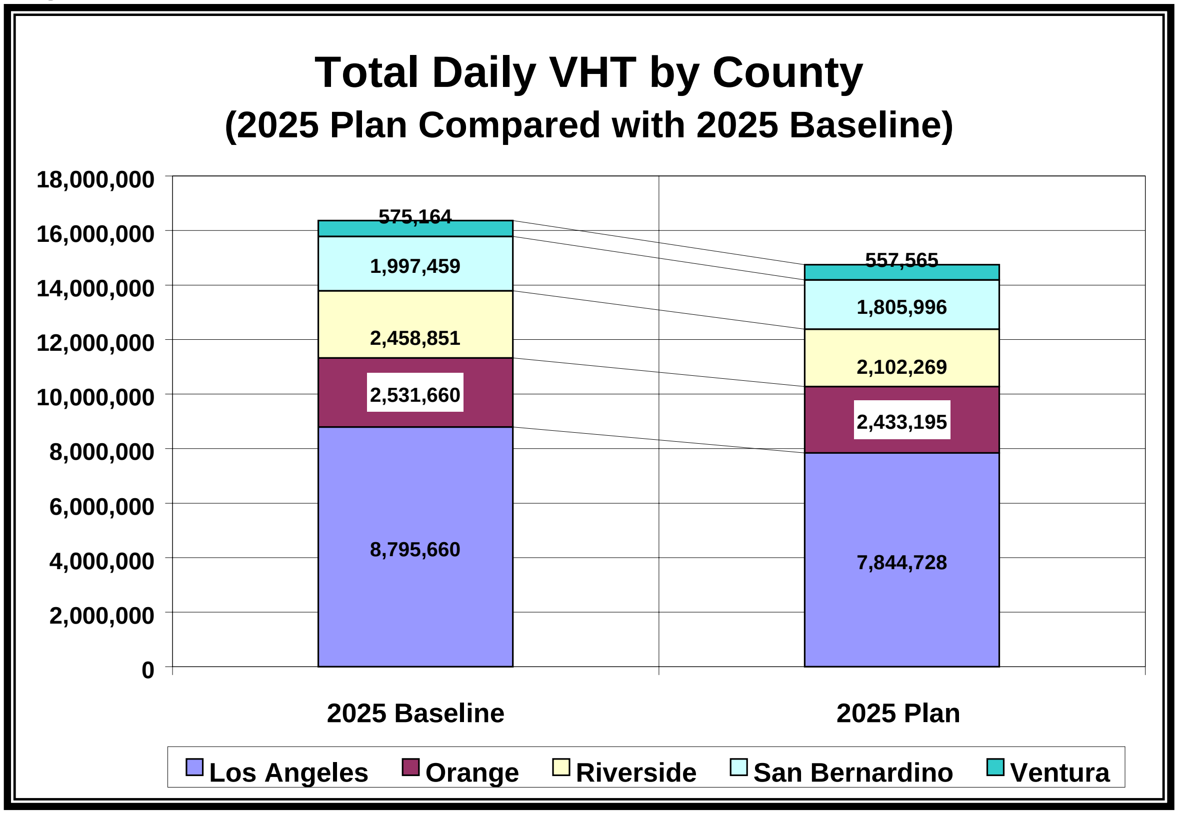

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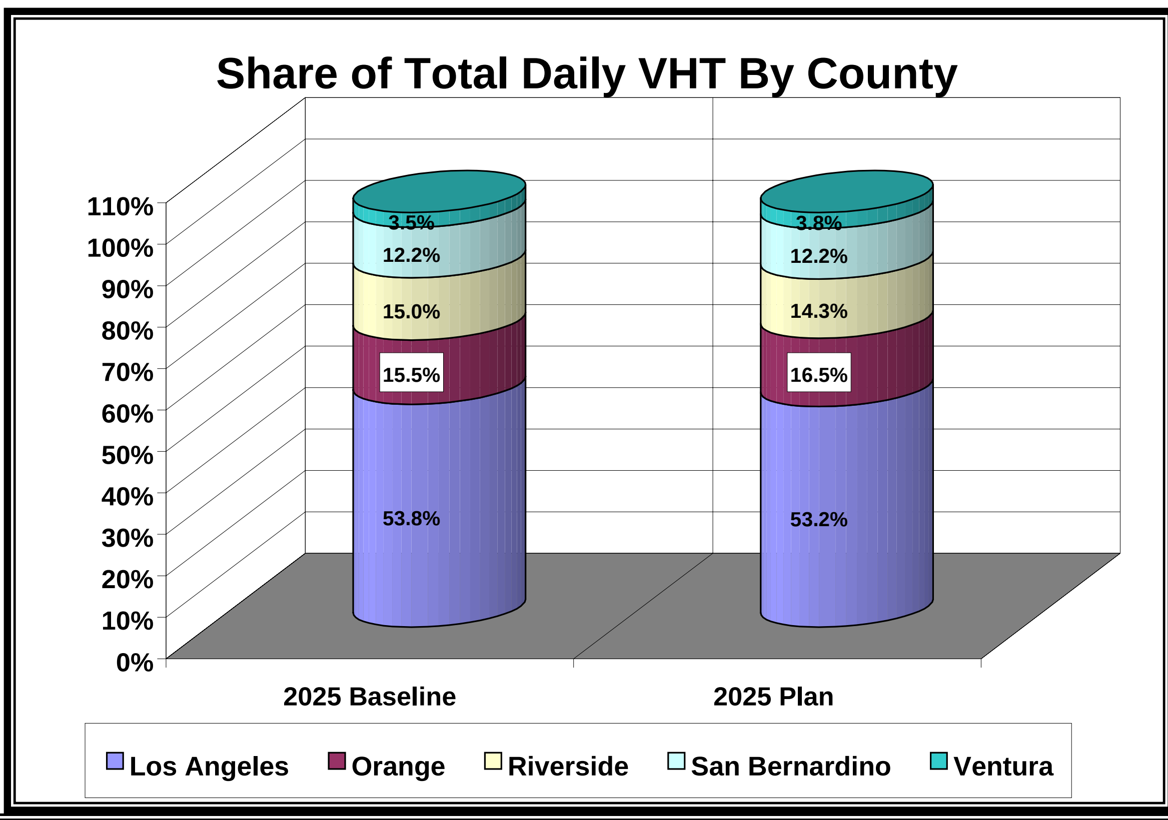

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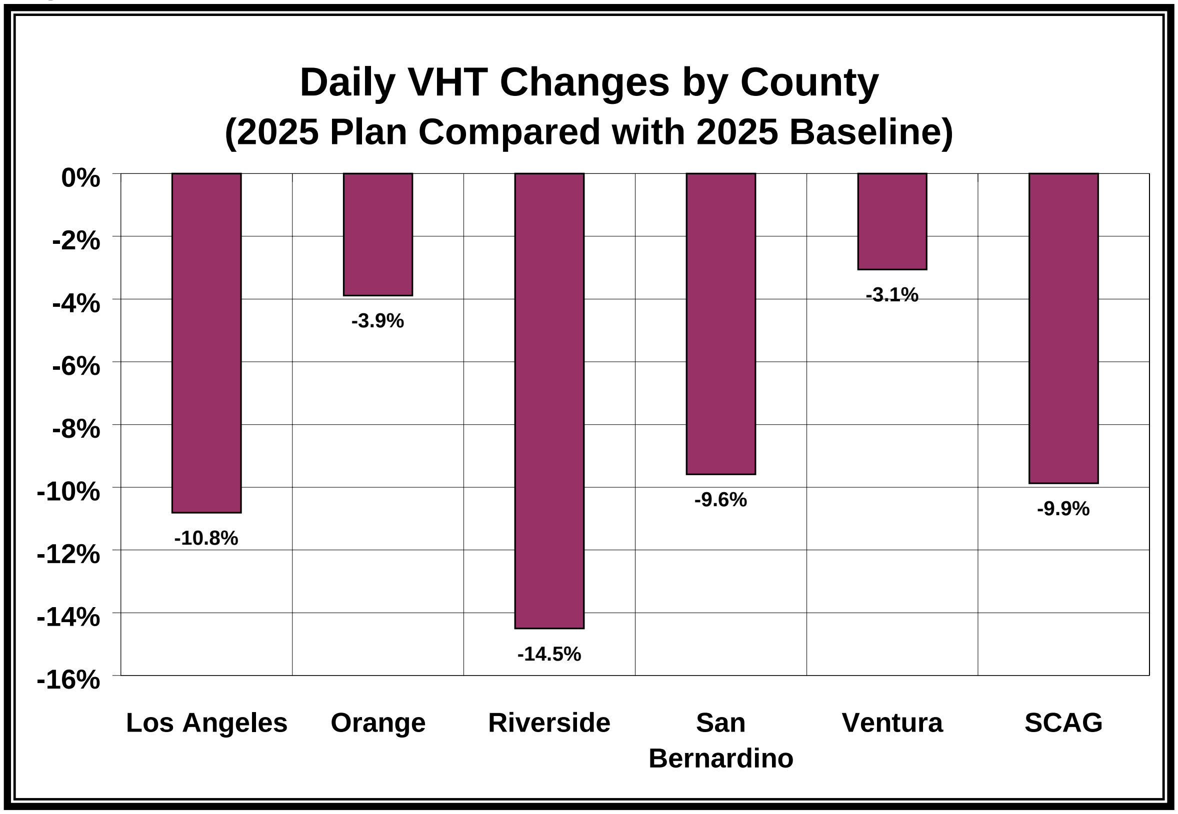

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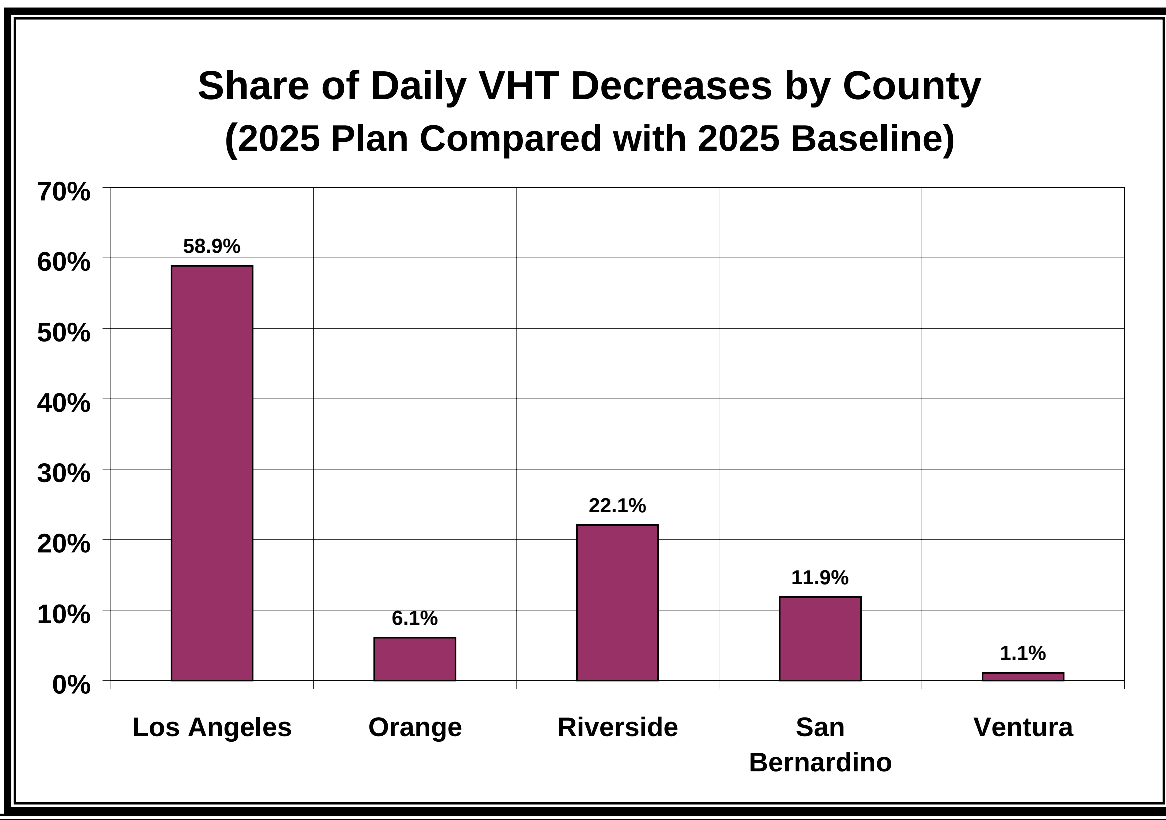

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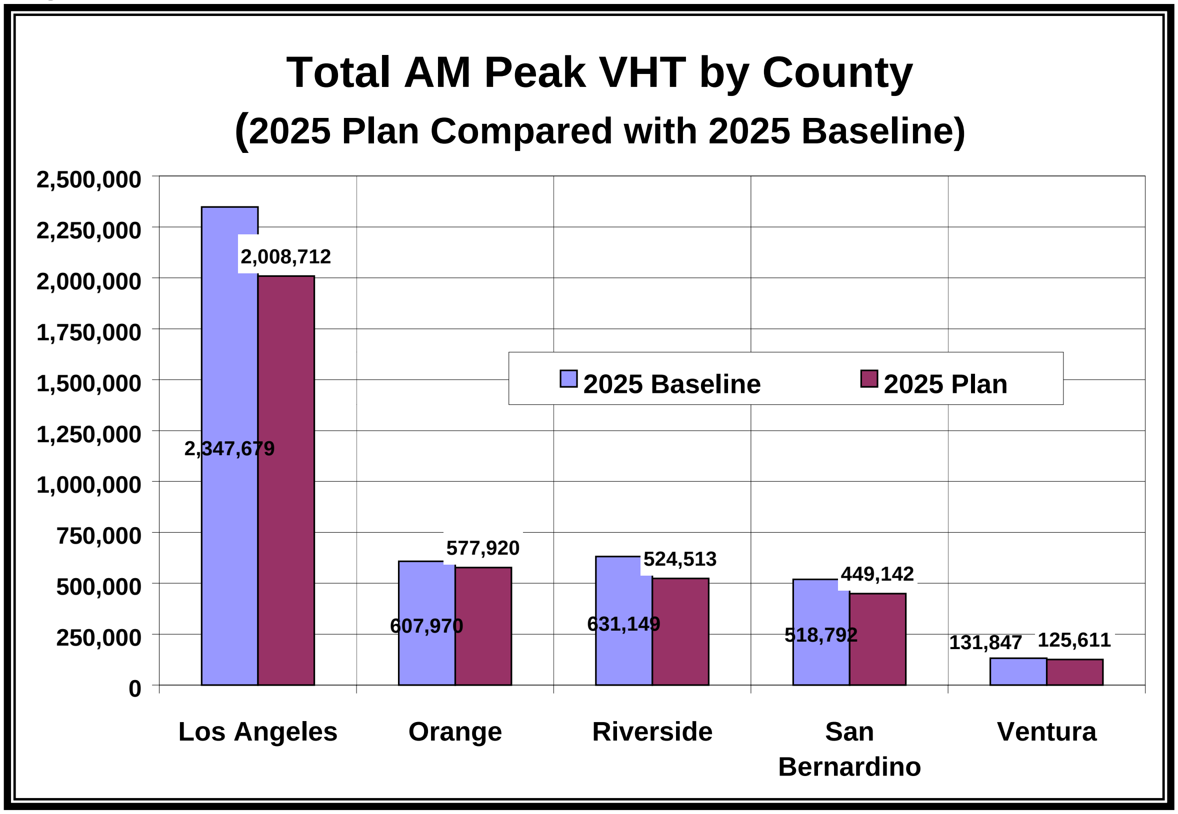

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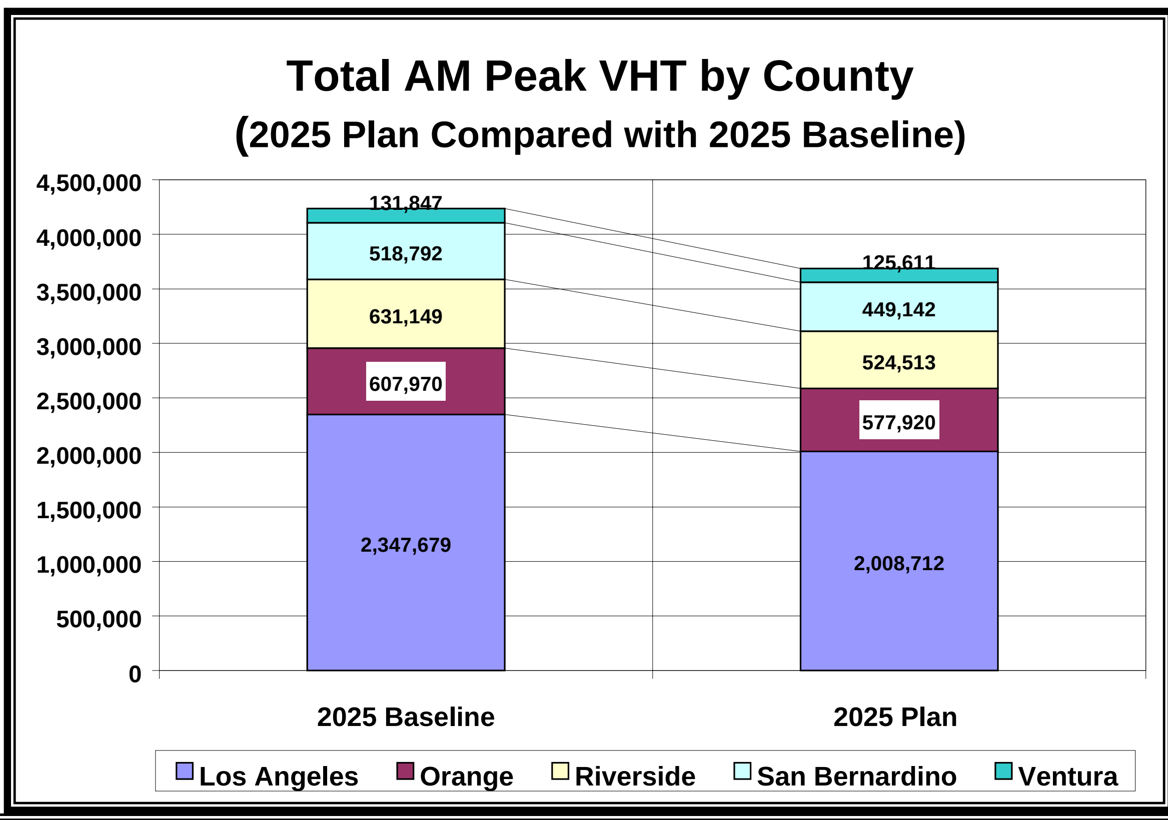

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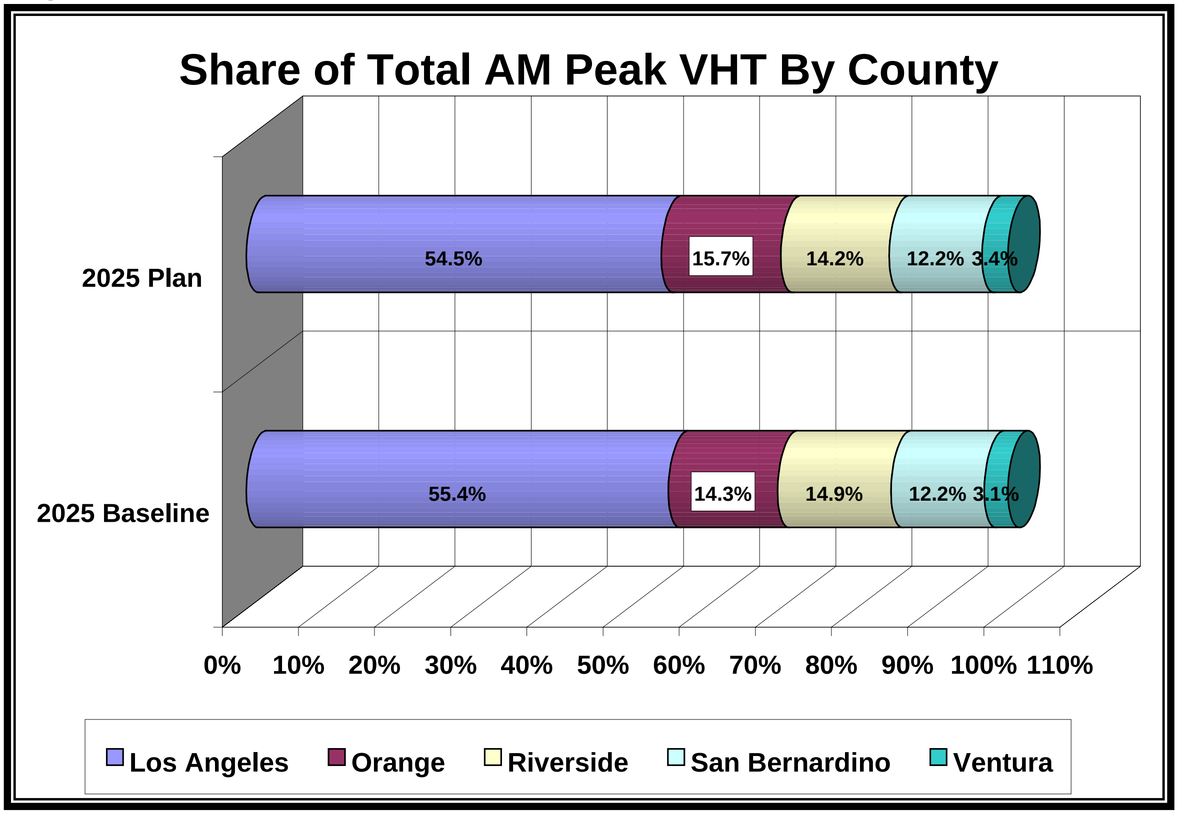

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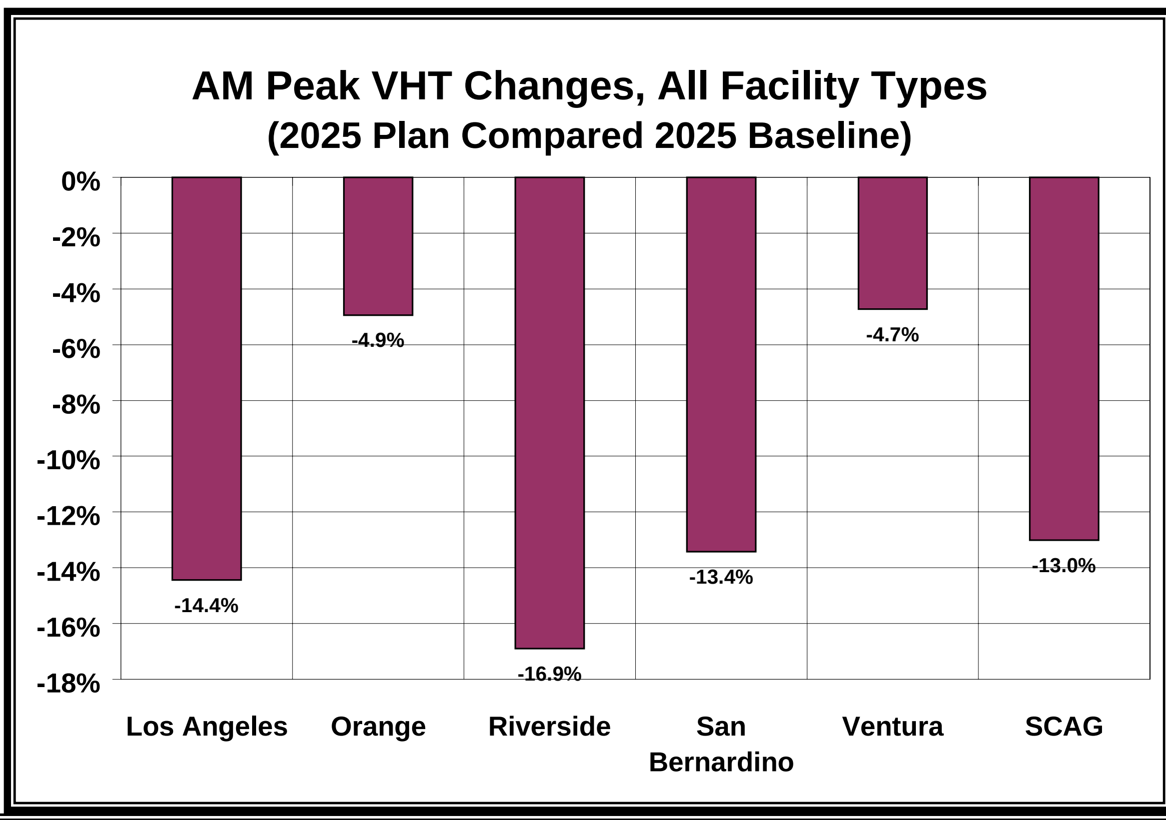

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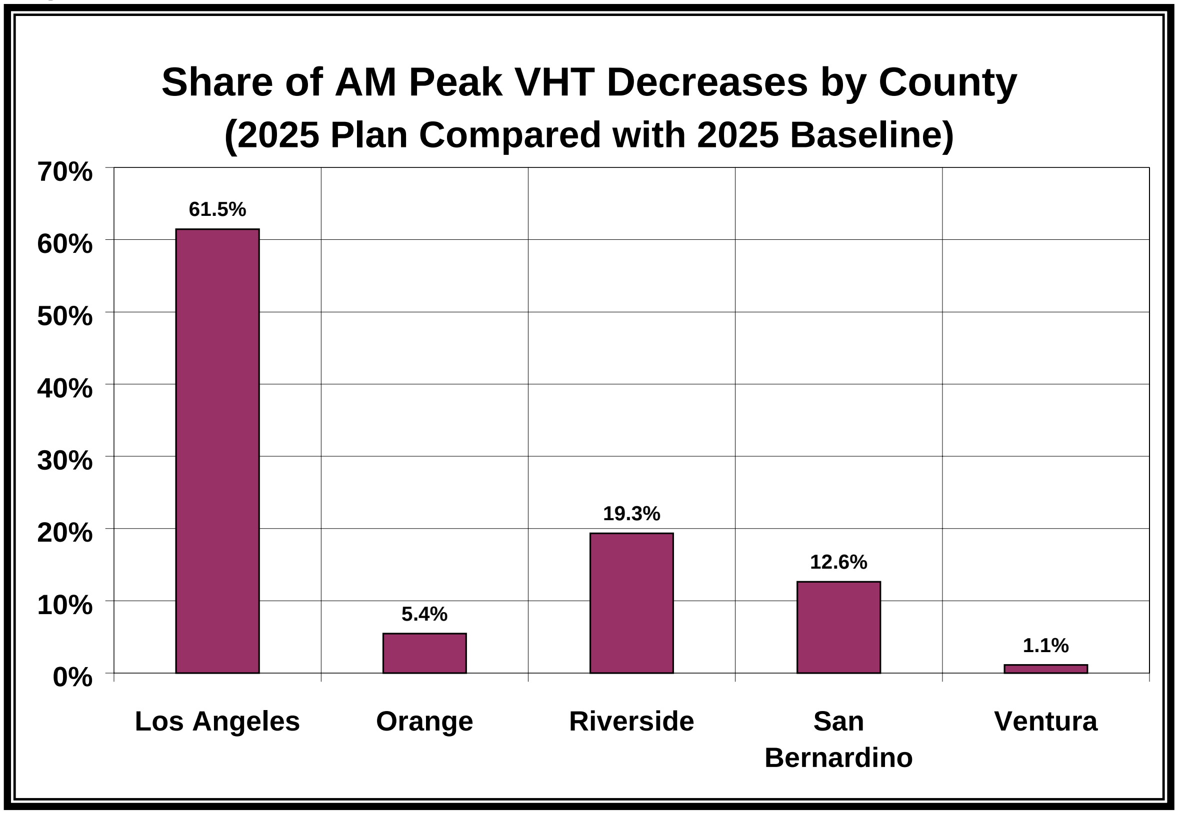

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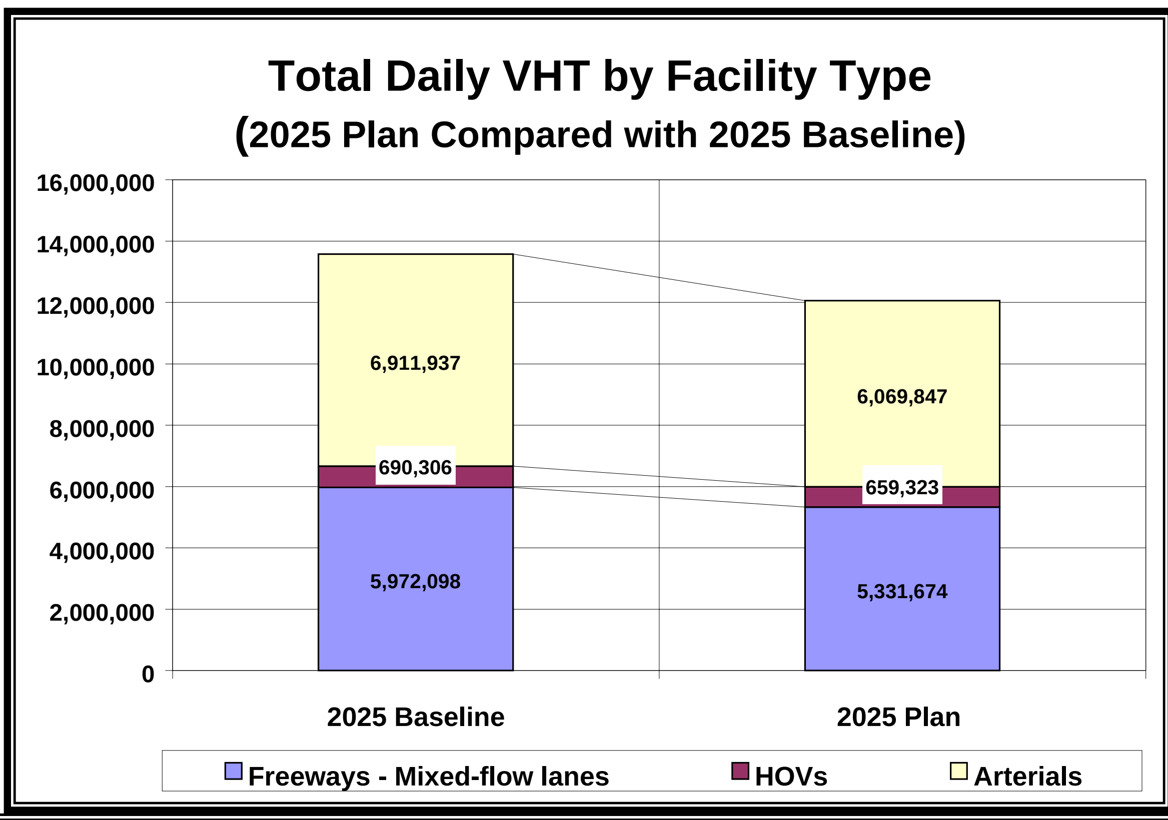

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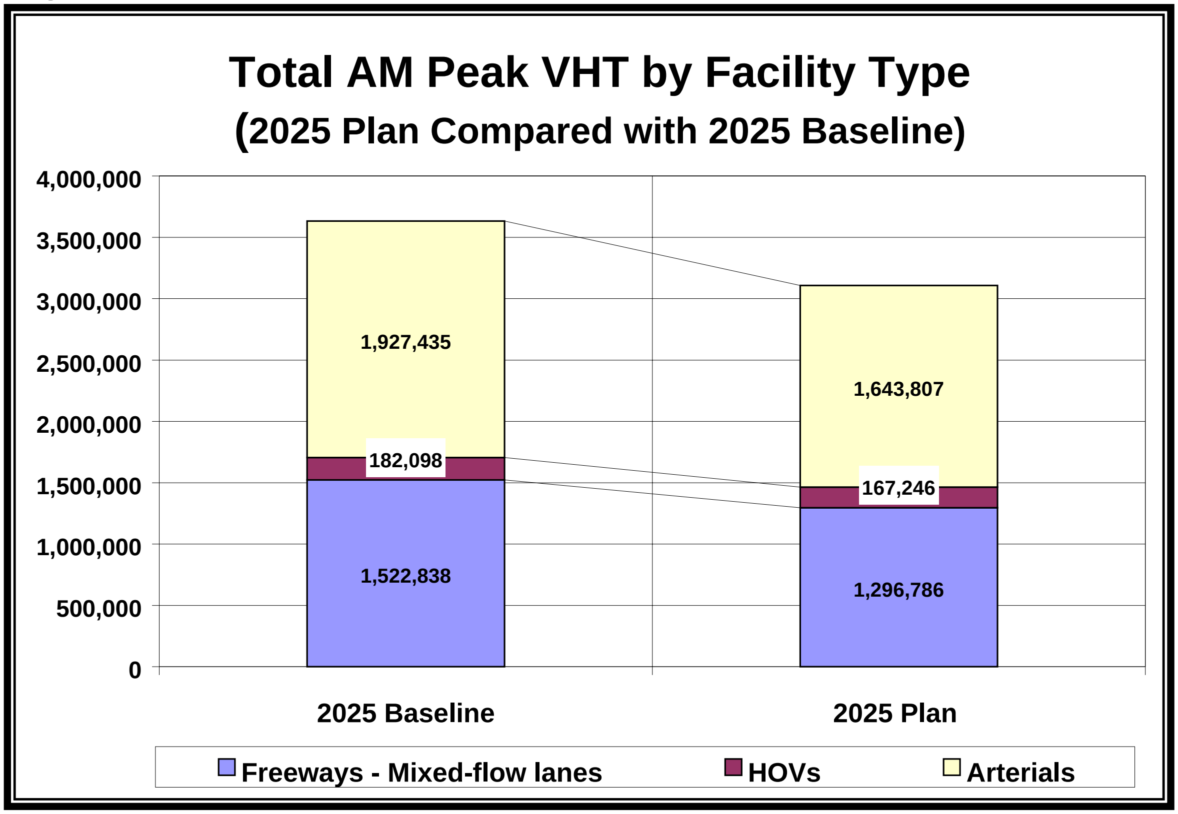

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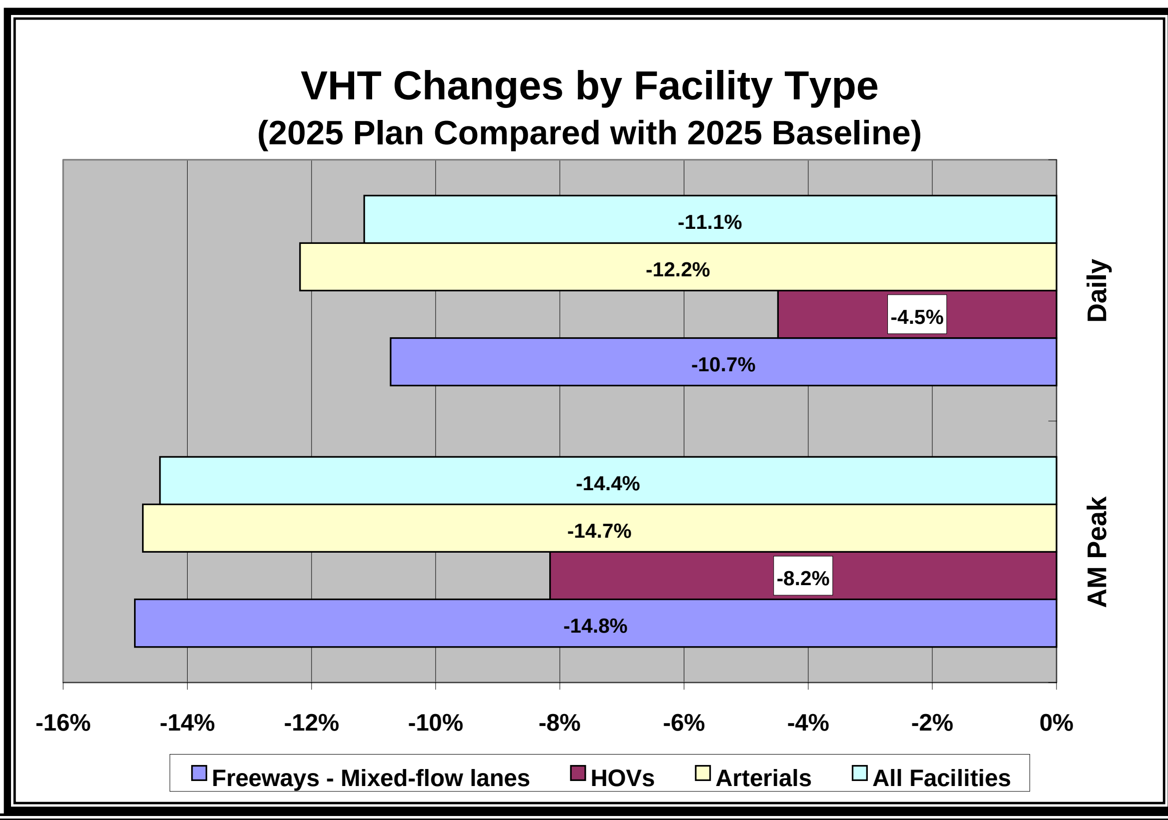

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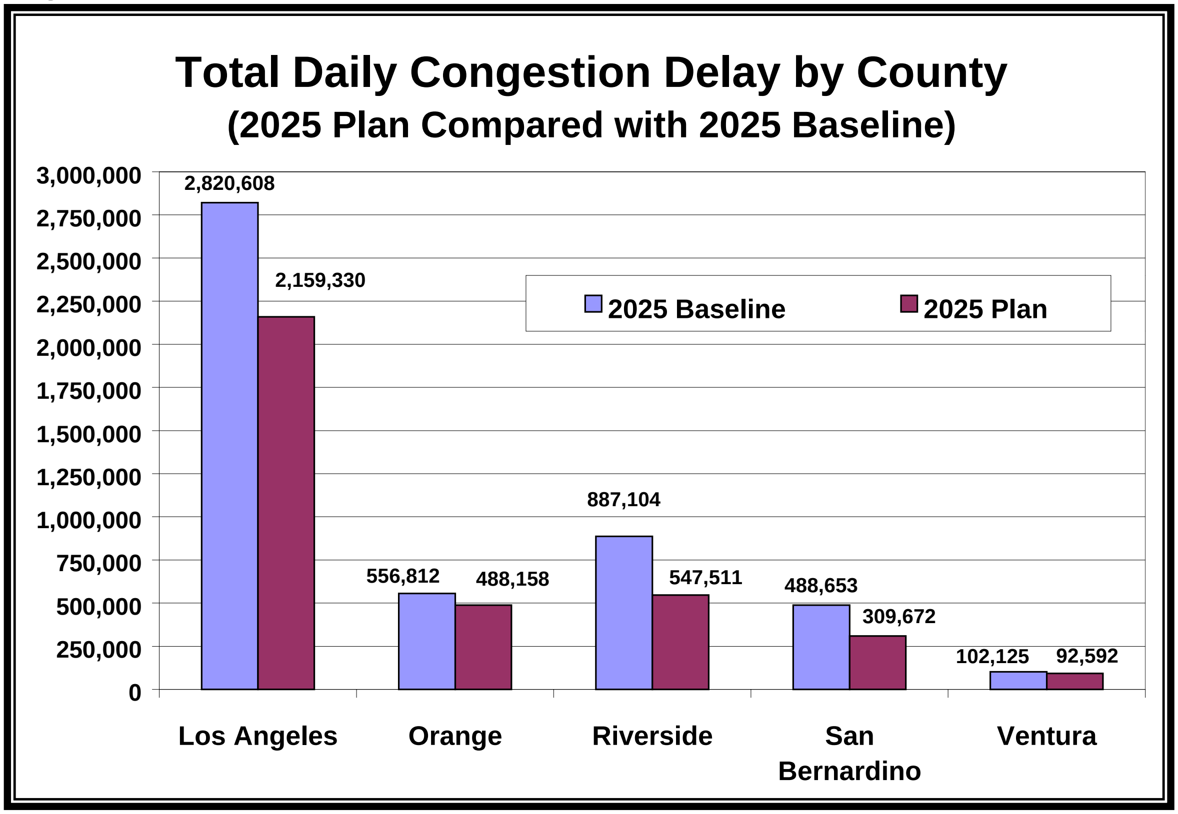

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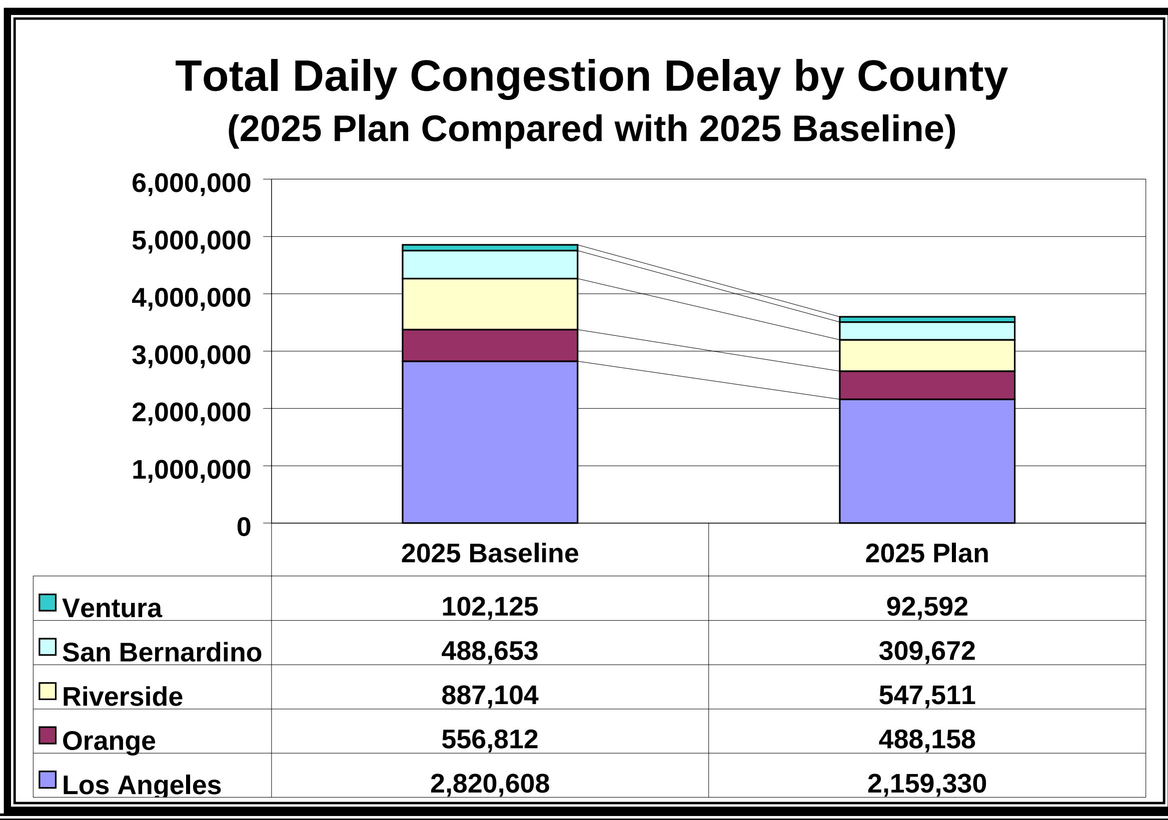

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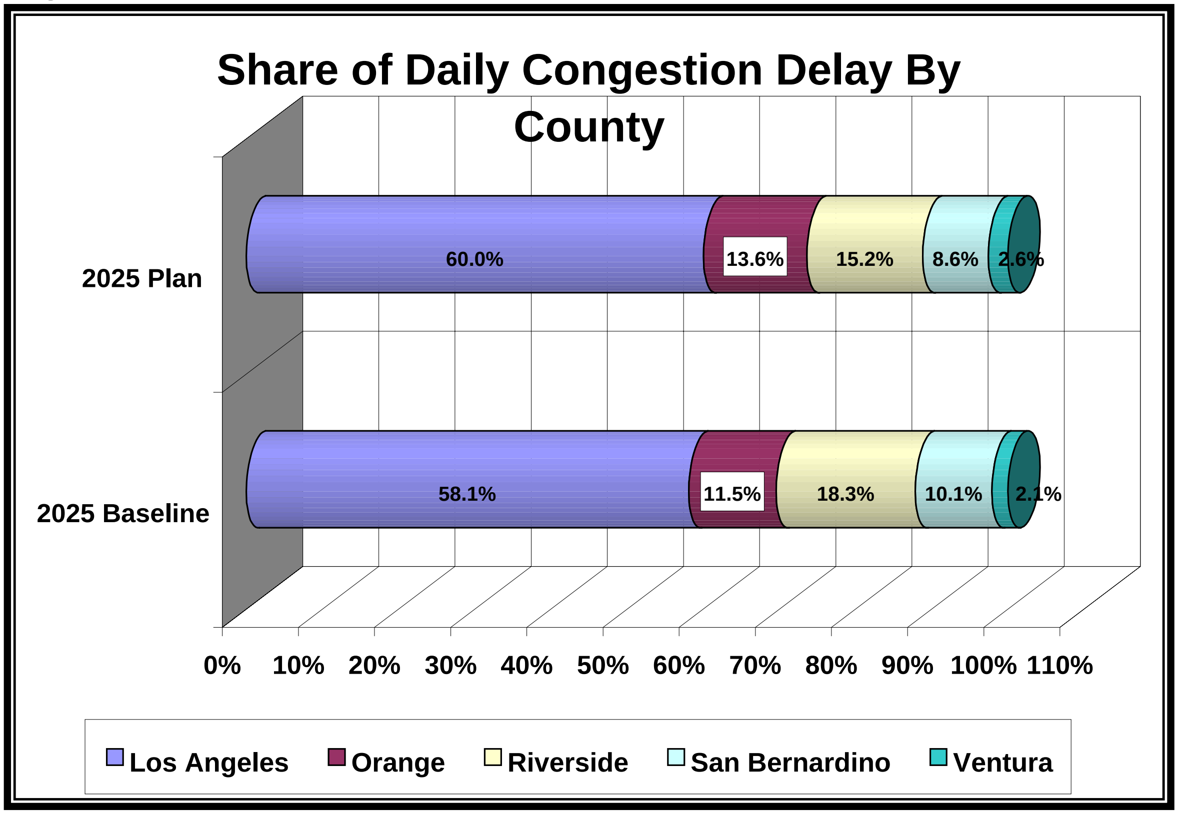

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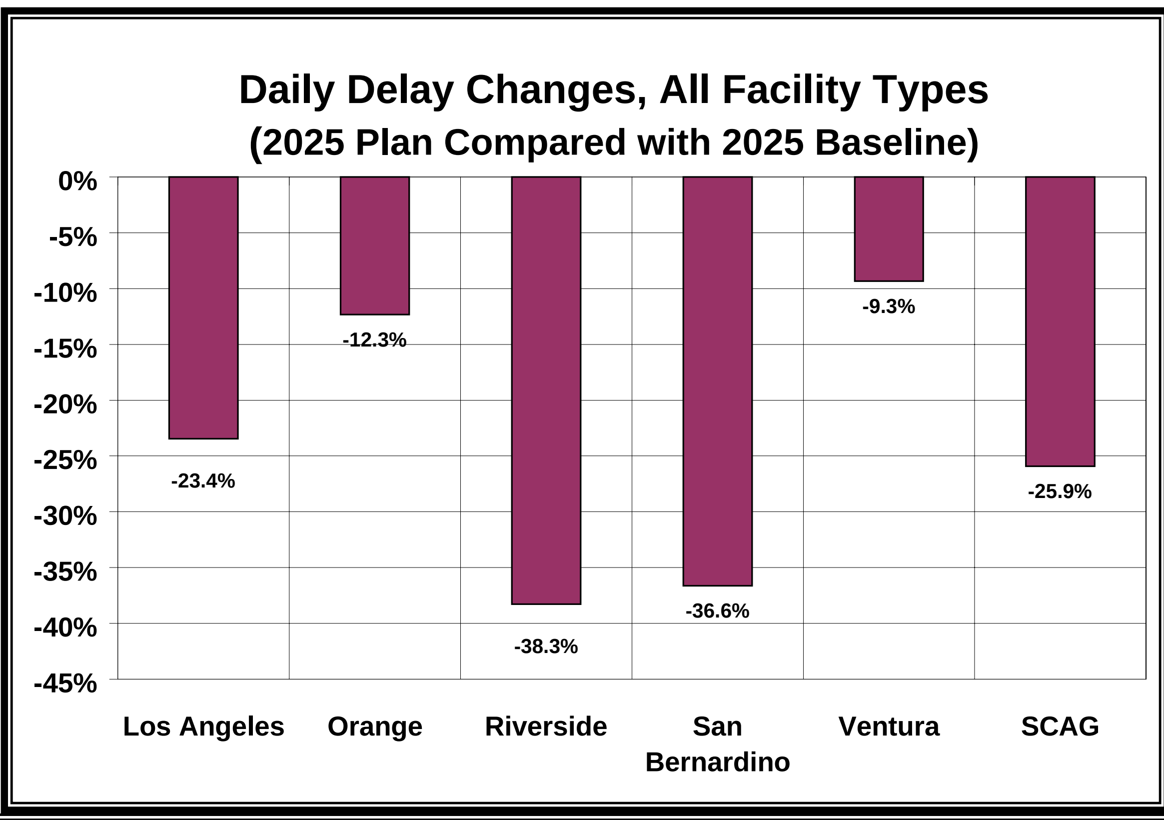

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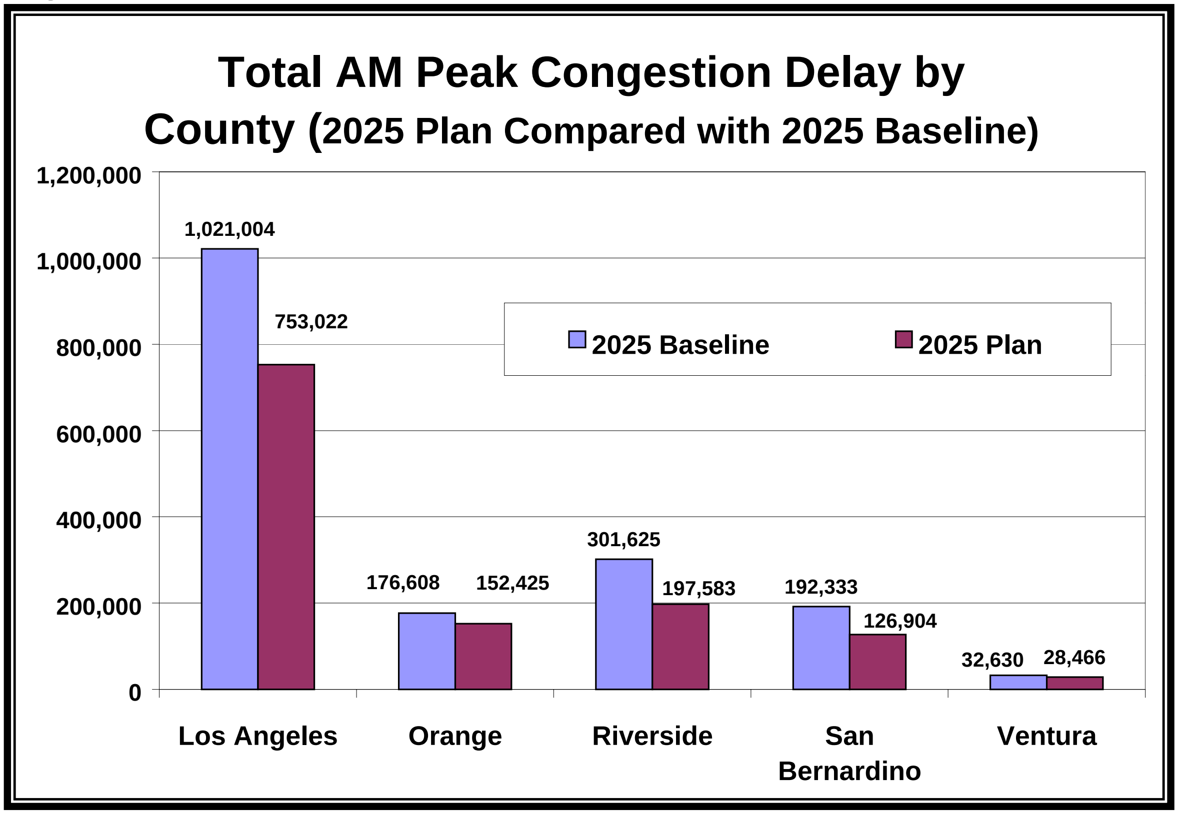

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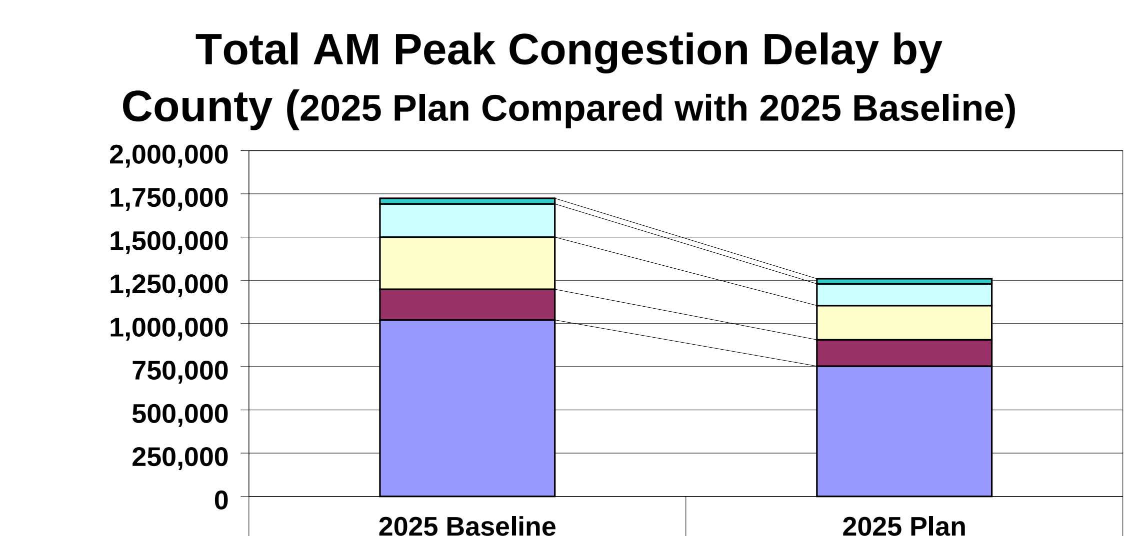


	2025 Baseline	2025 Plan
Ventura	32,630	28,466
San Bernardino	192,333	126,904
Riverside	301,625	197,583
Orange	176,608	152,425
Los Angeles	1,021,004	753,022

Figure J.26

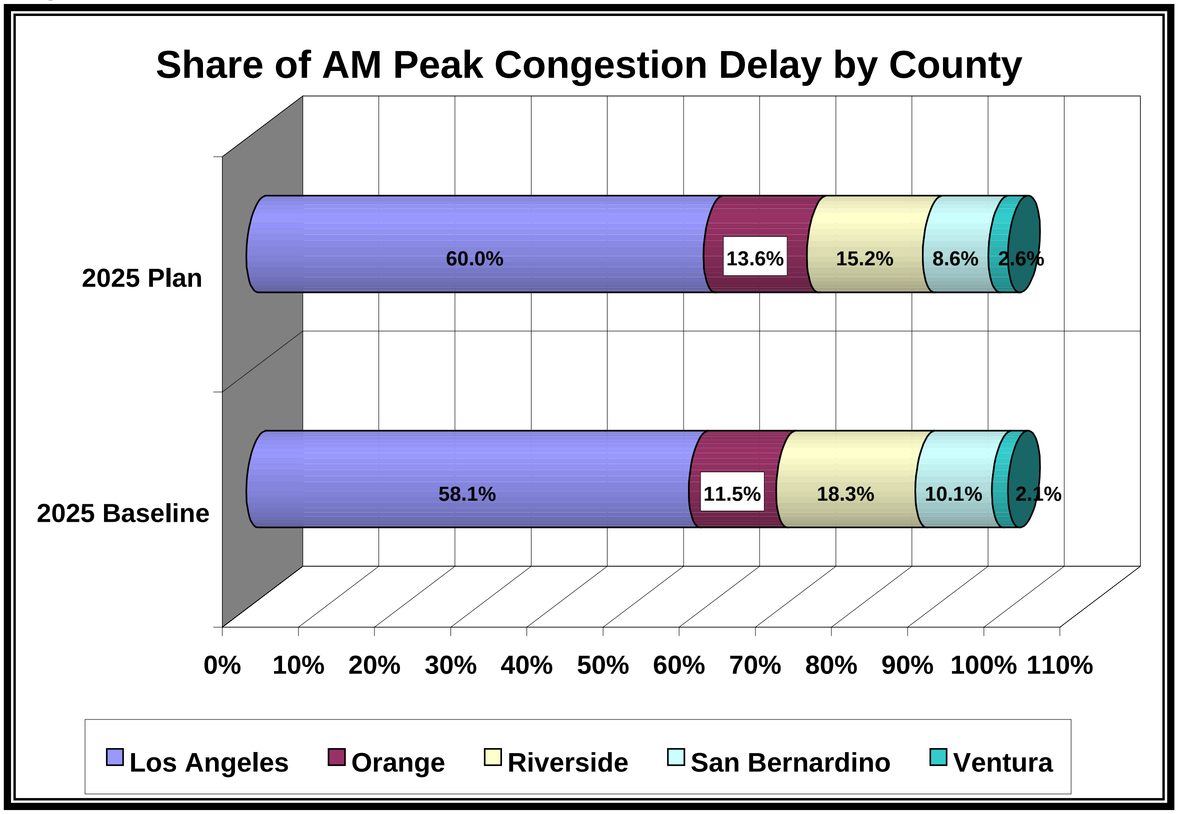
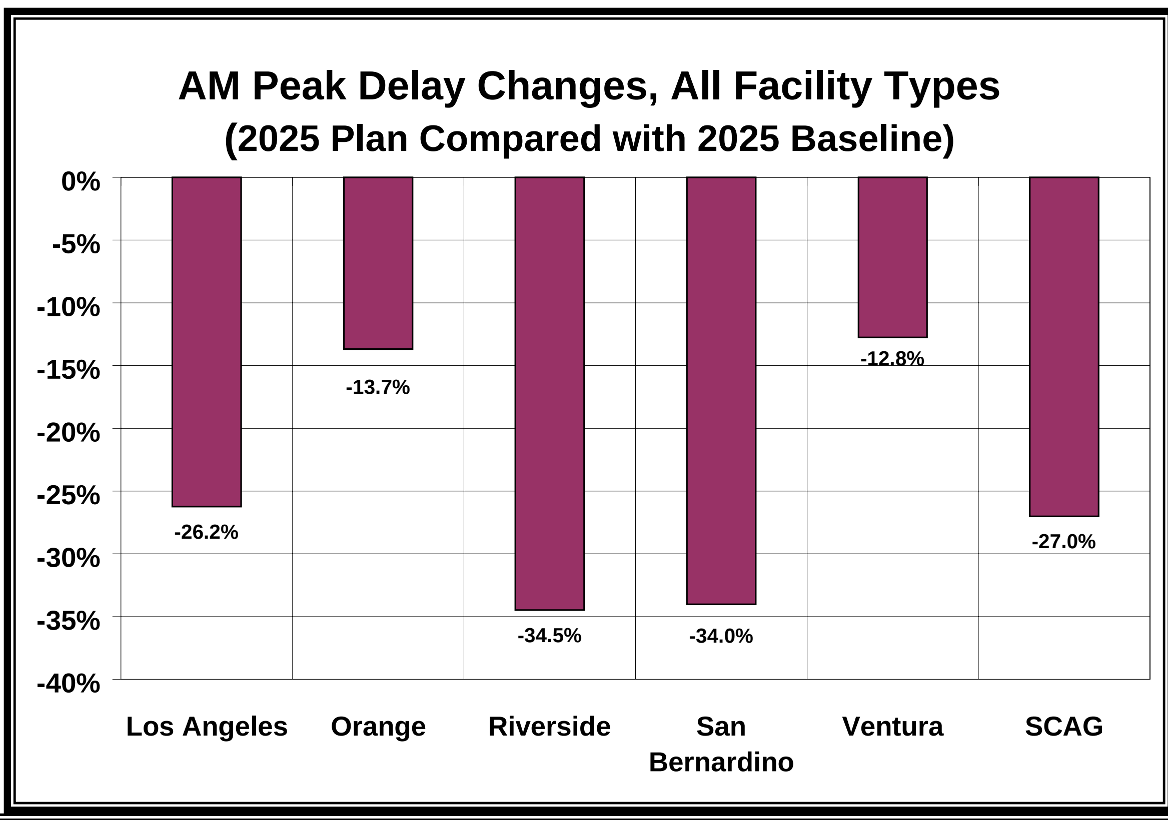


Figure J.27



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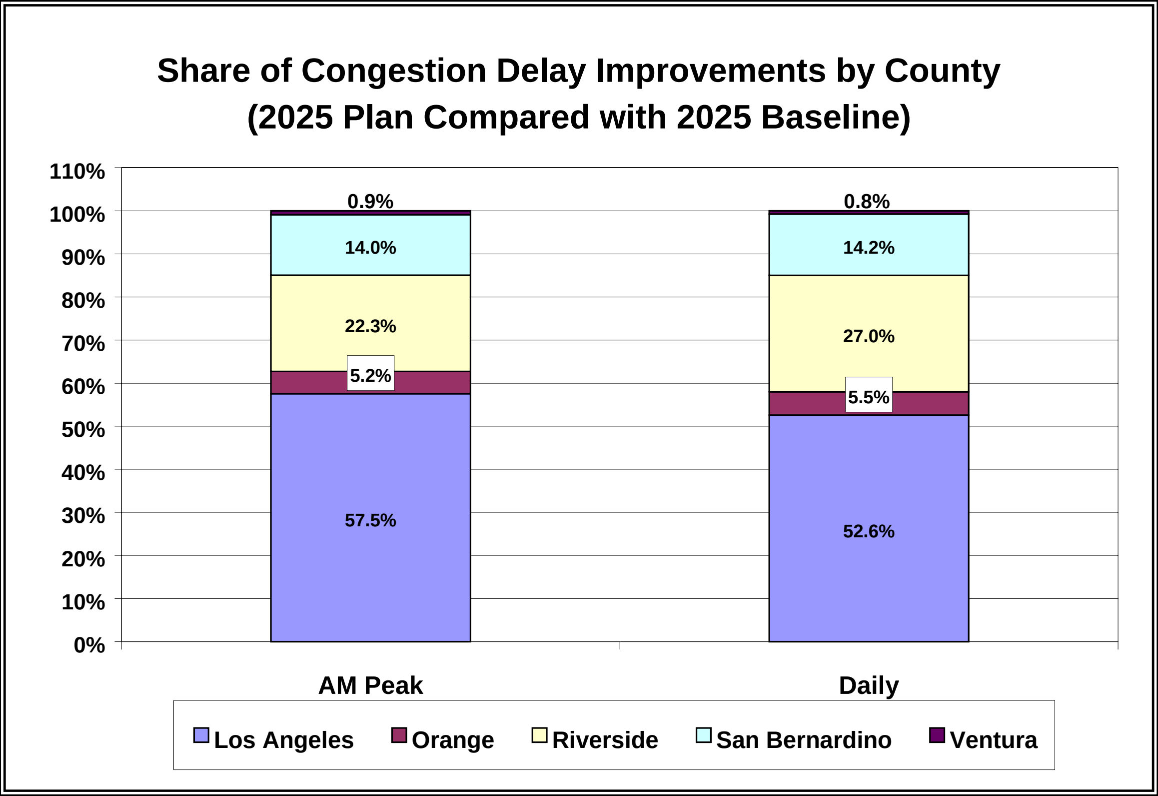

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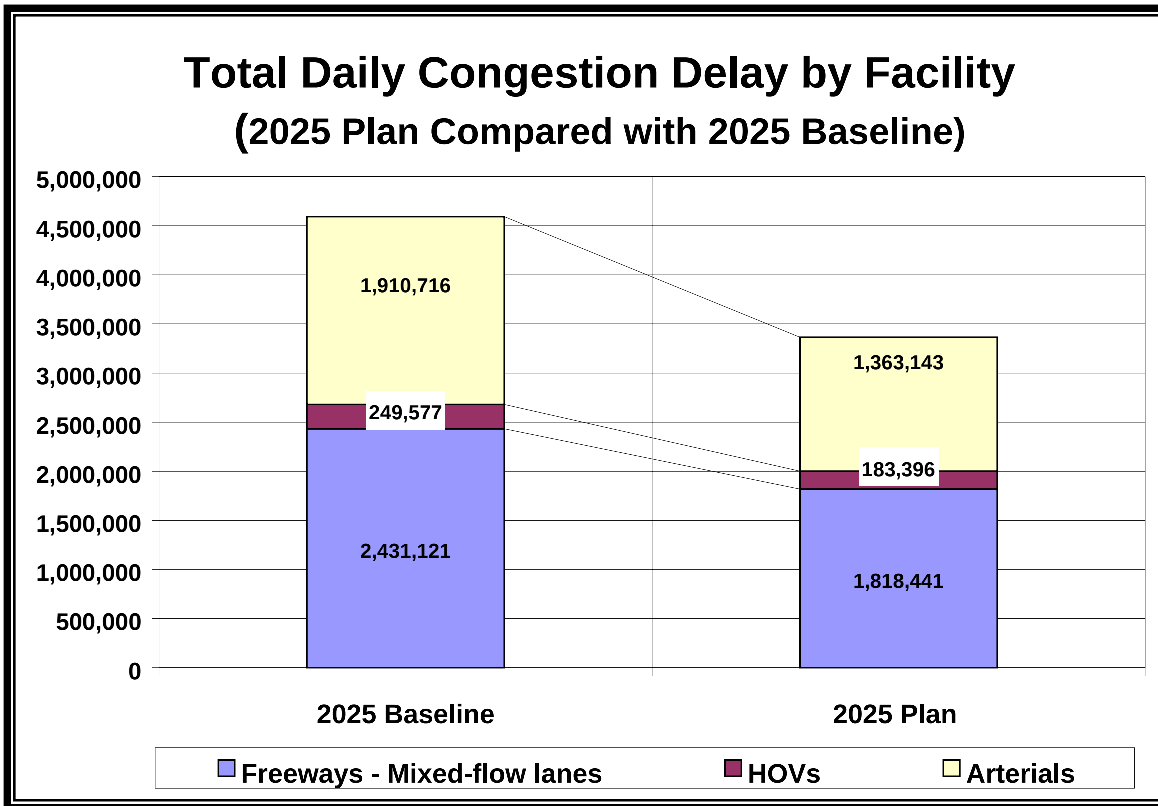

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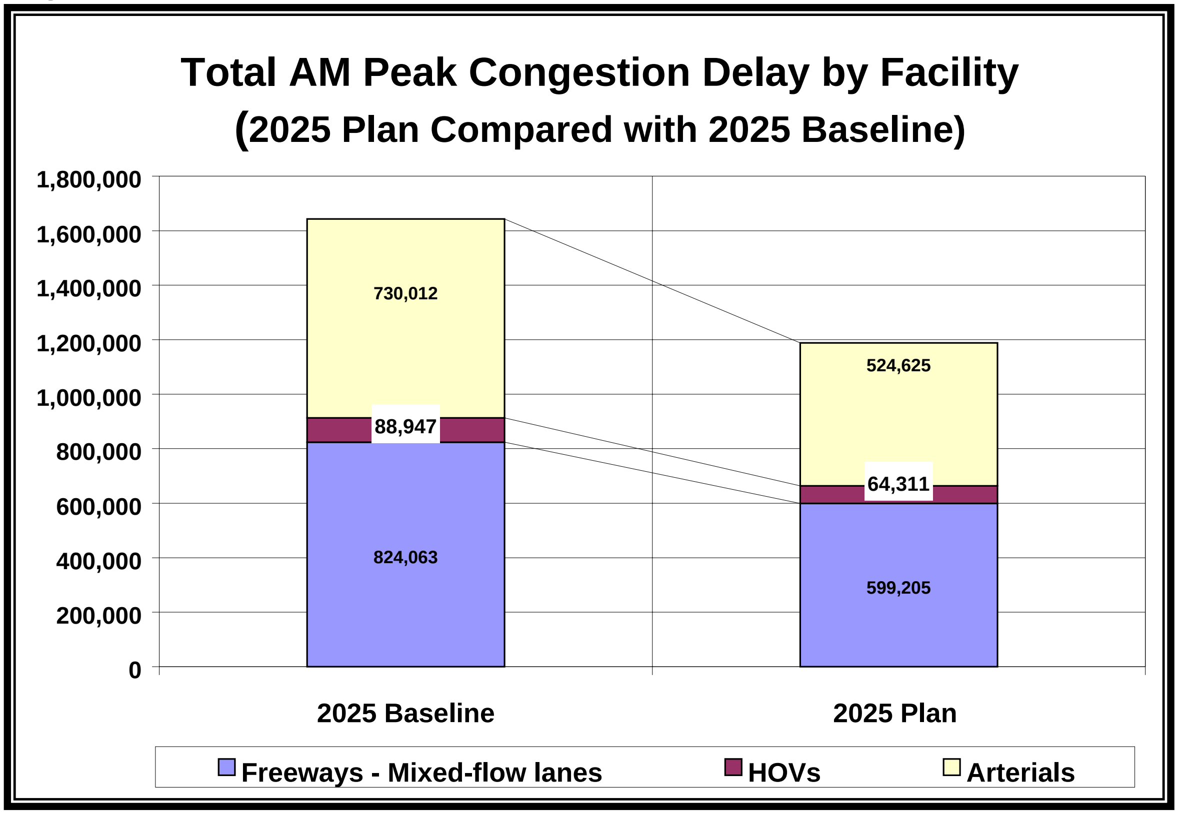

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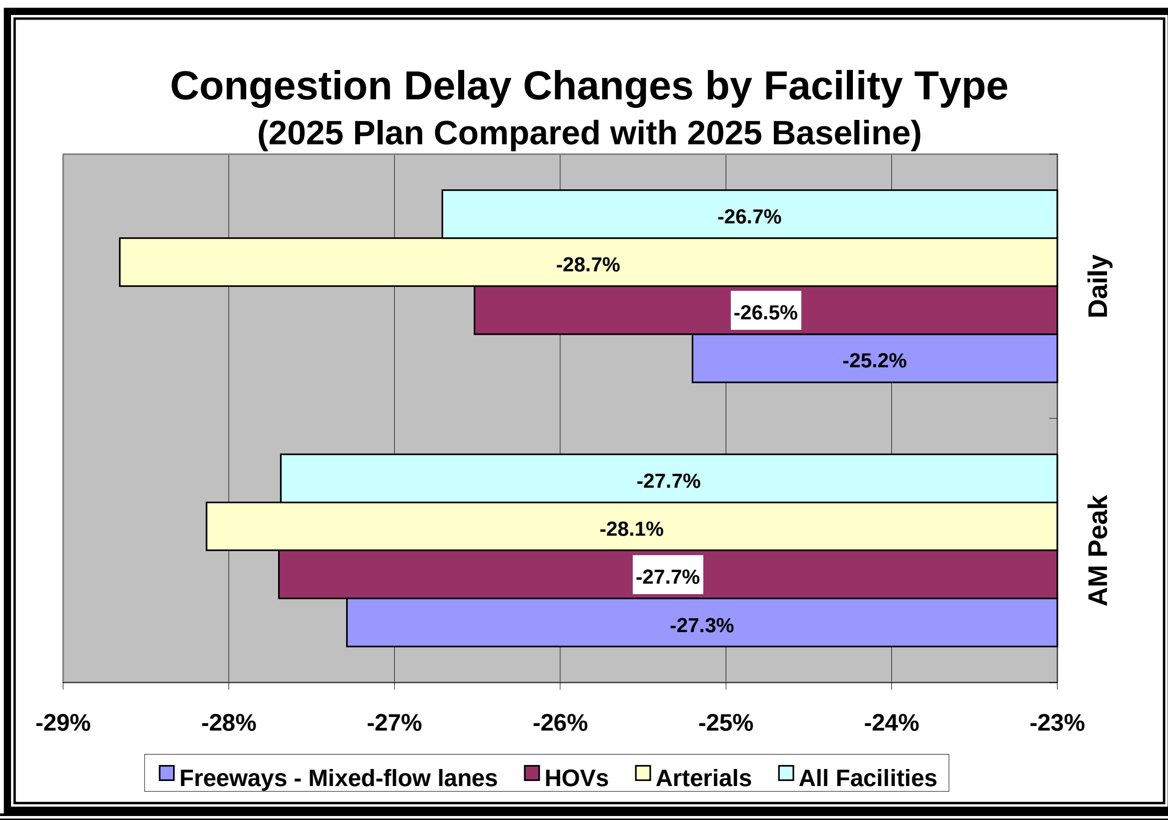

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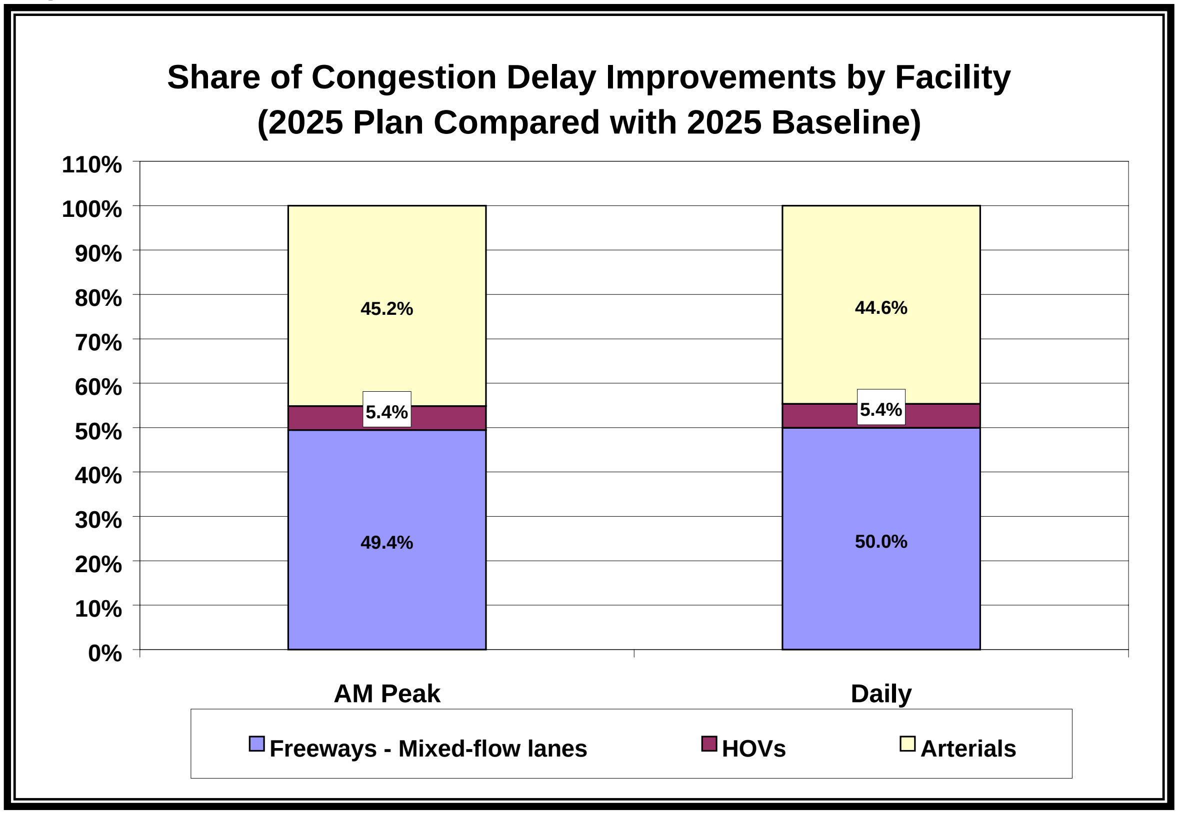

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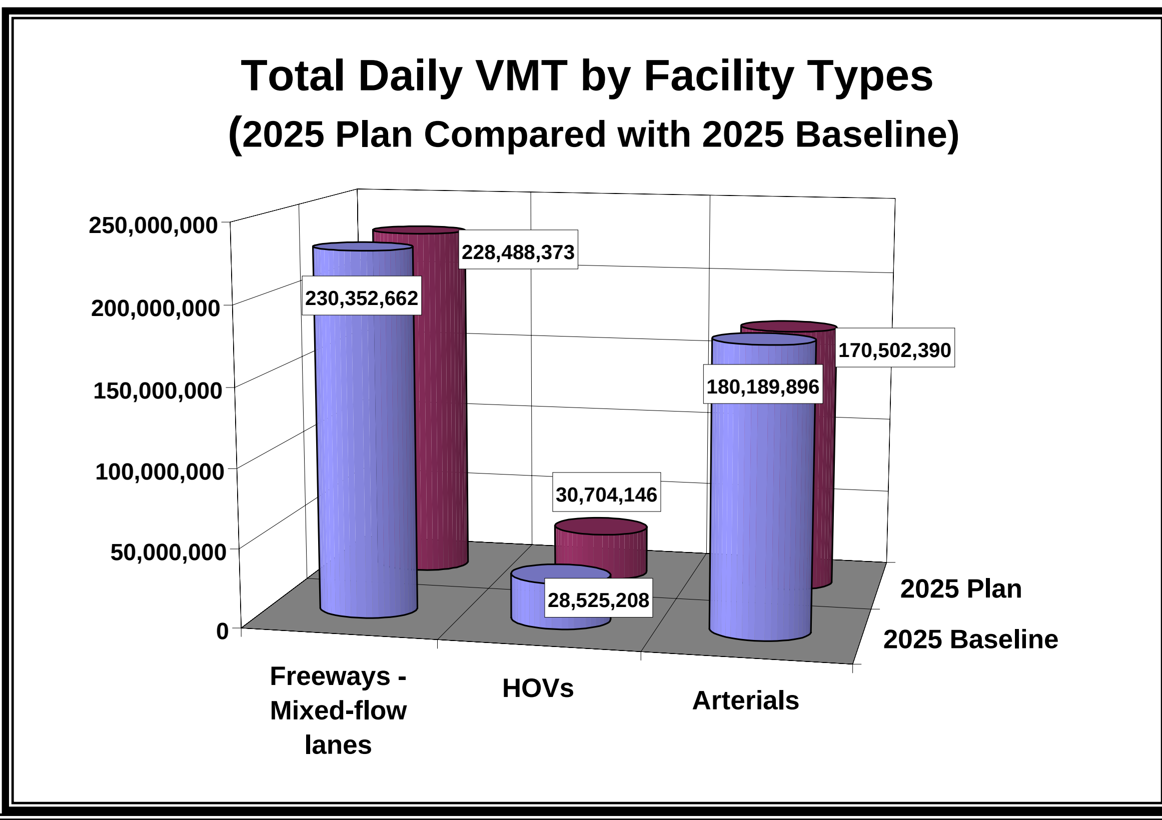

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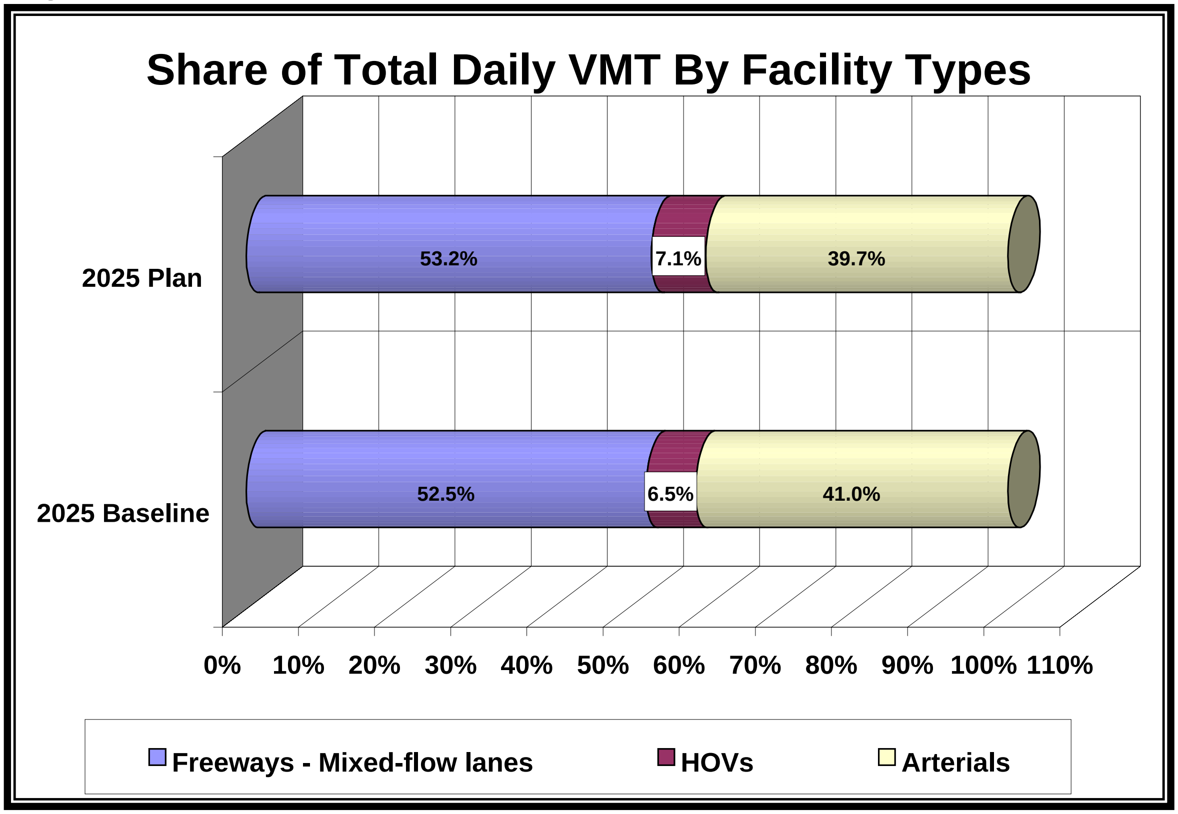

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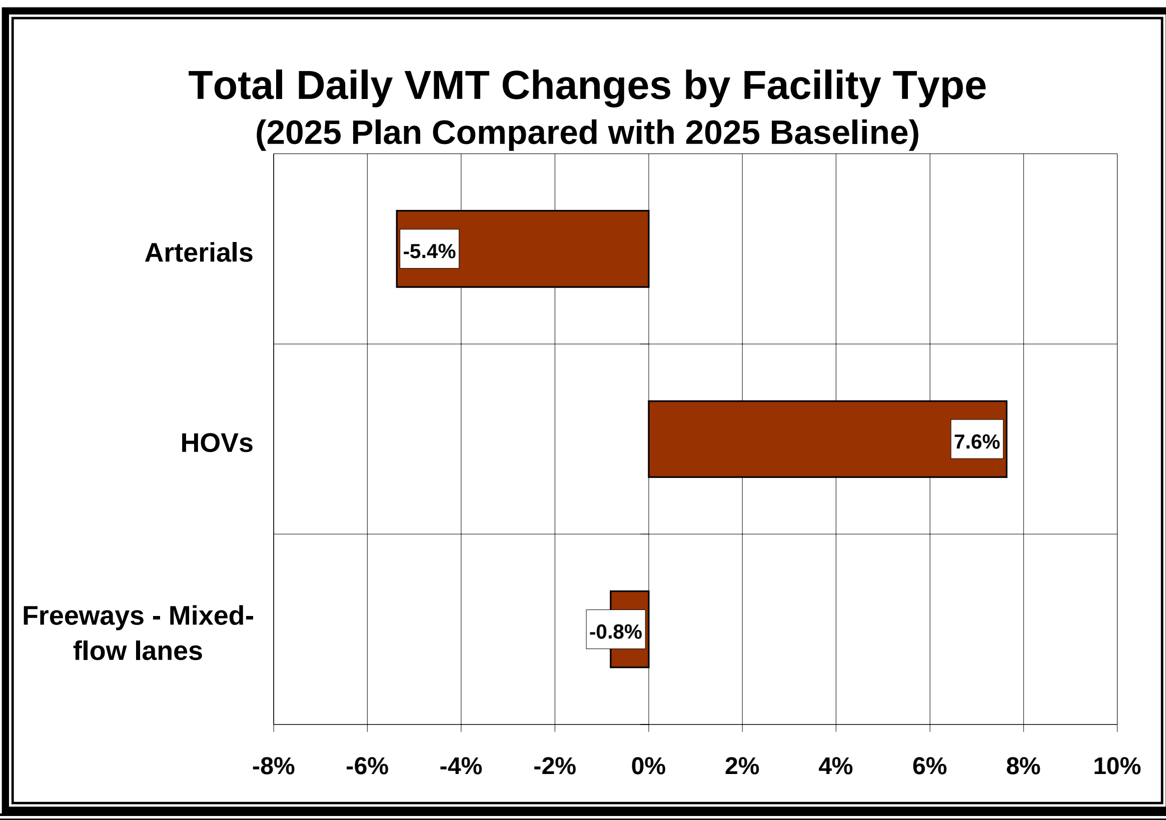

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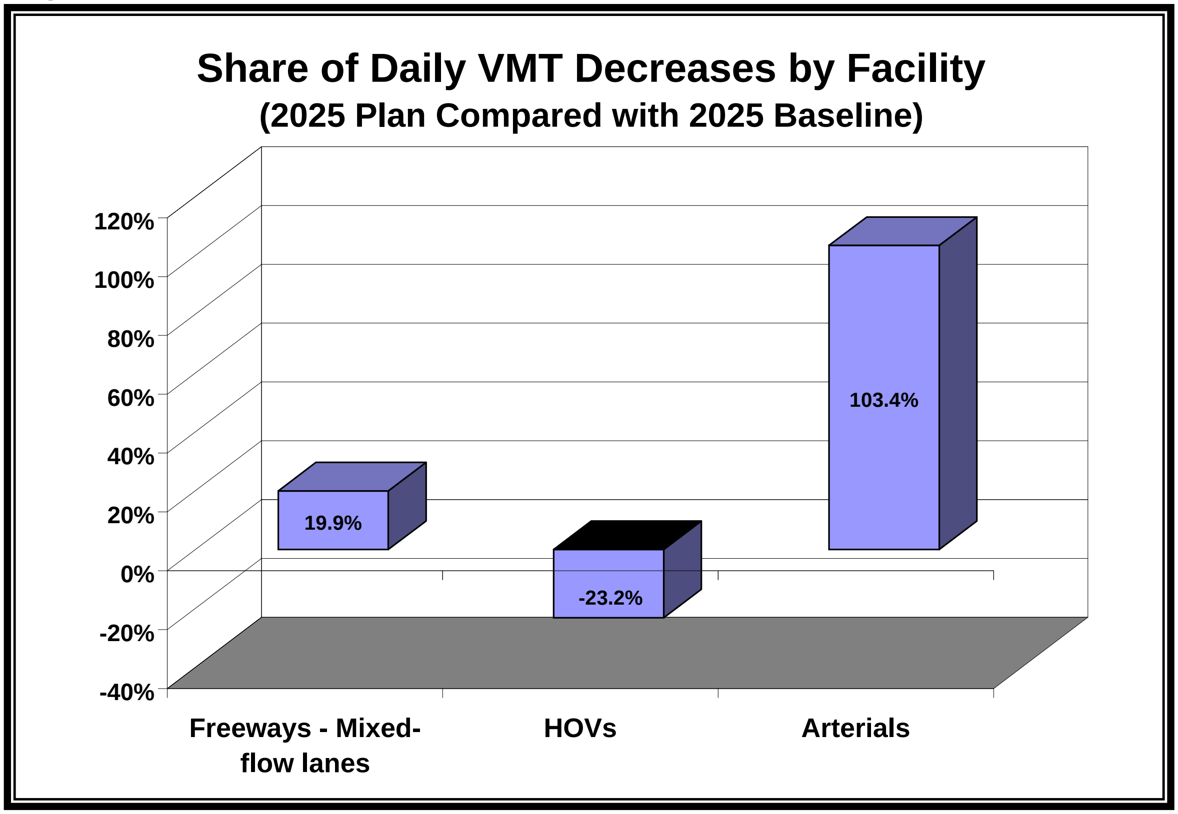

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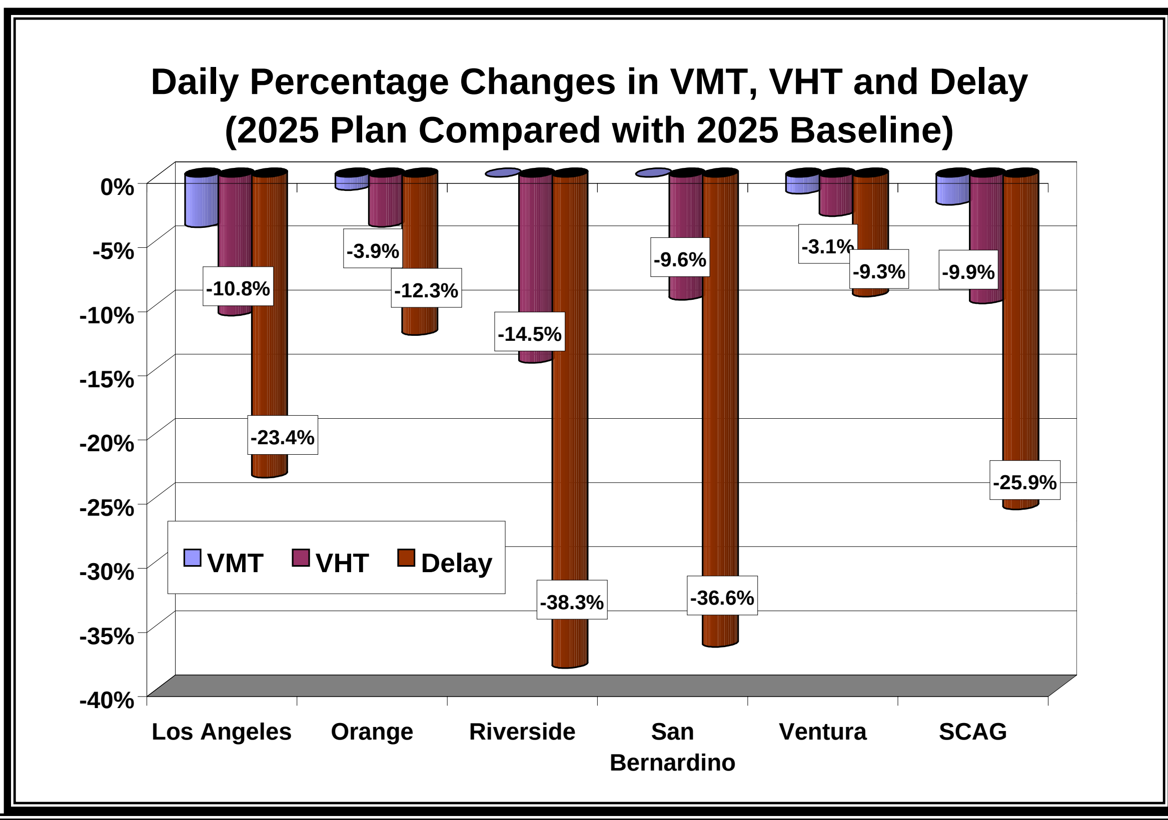

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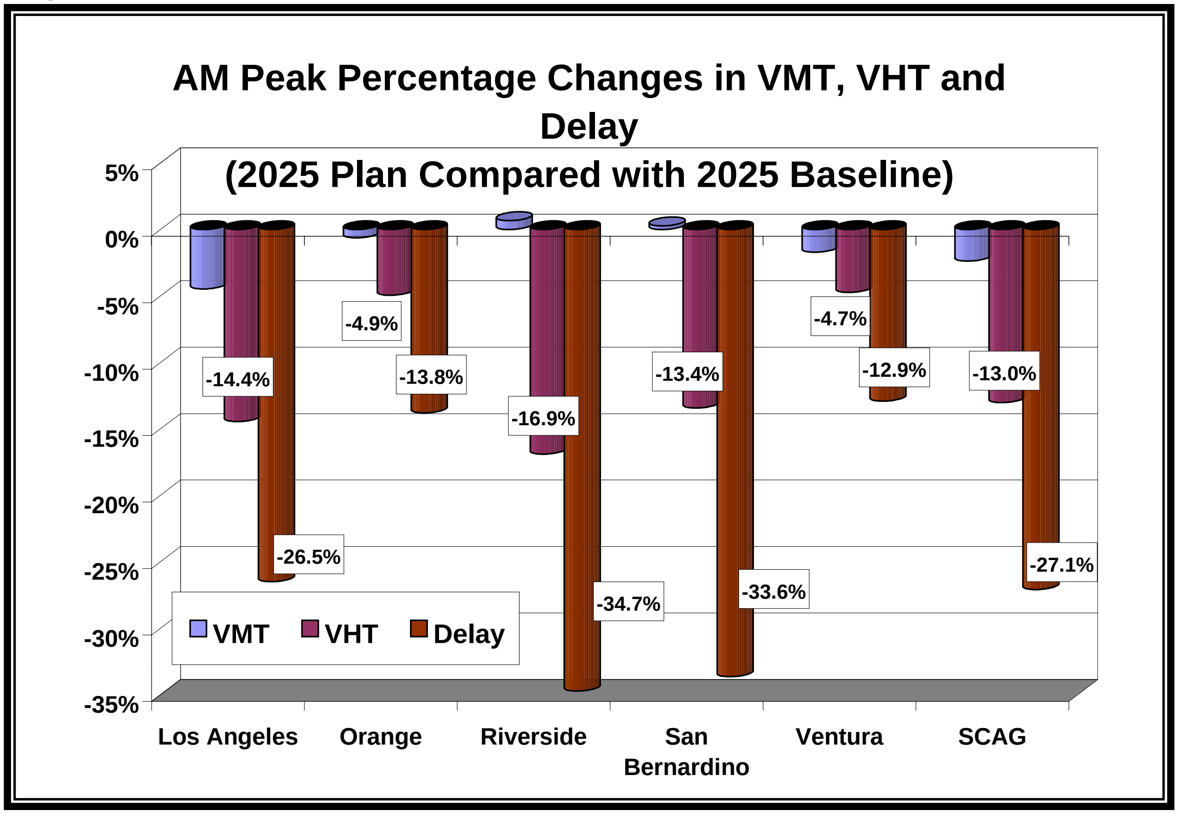

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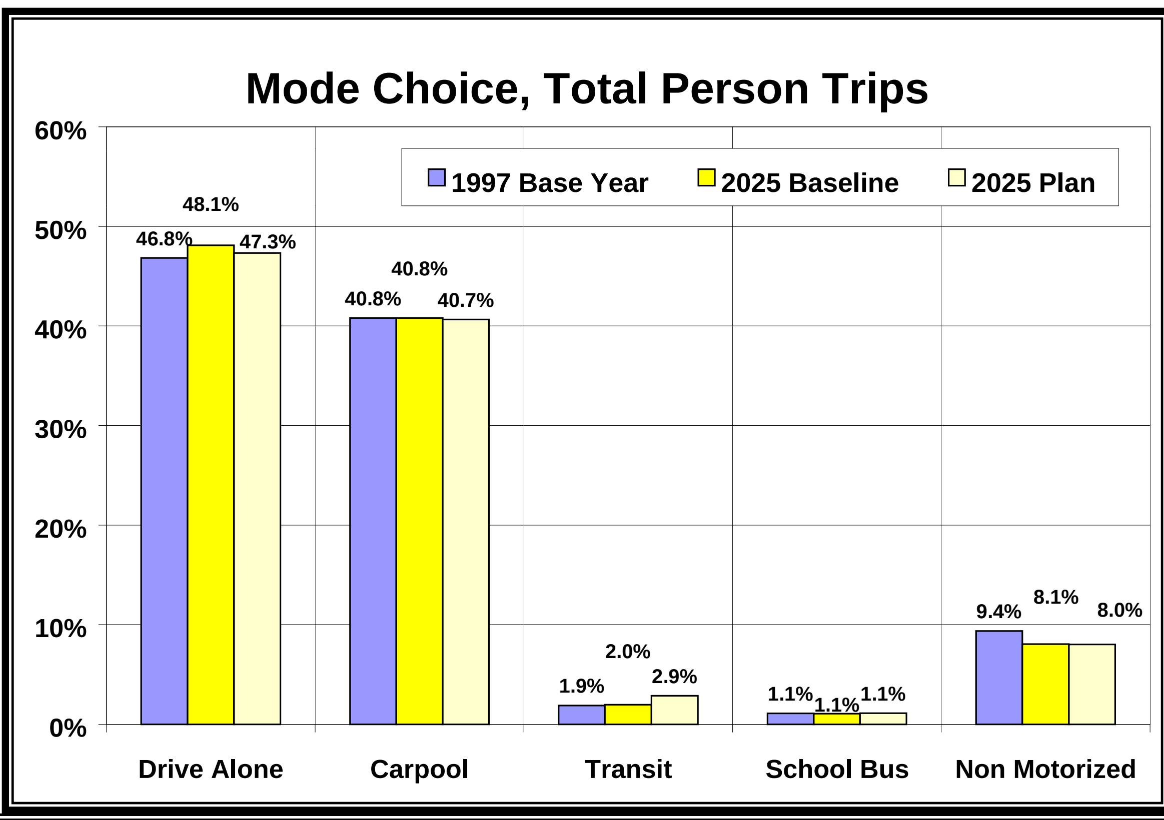

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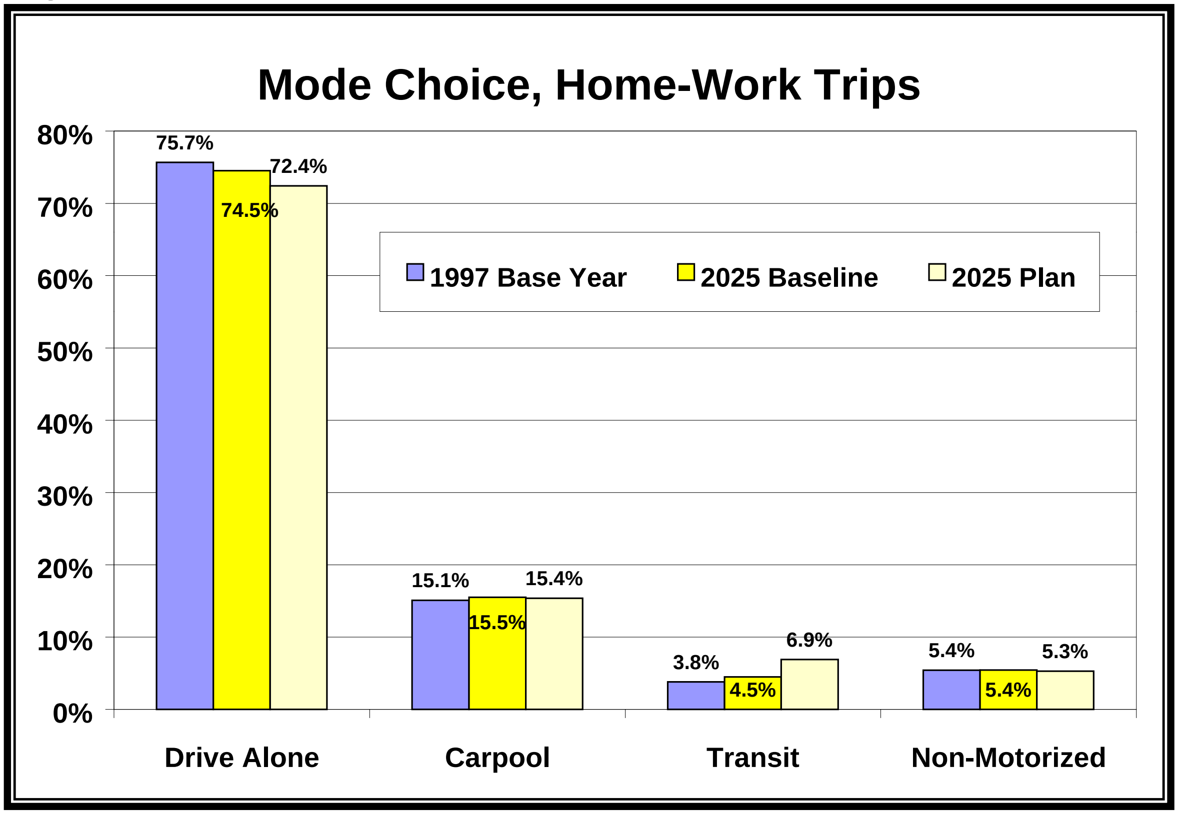

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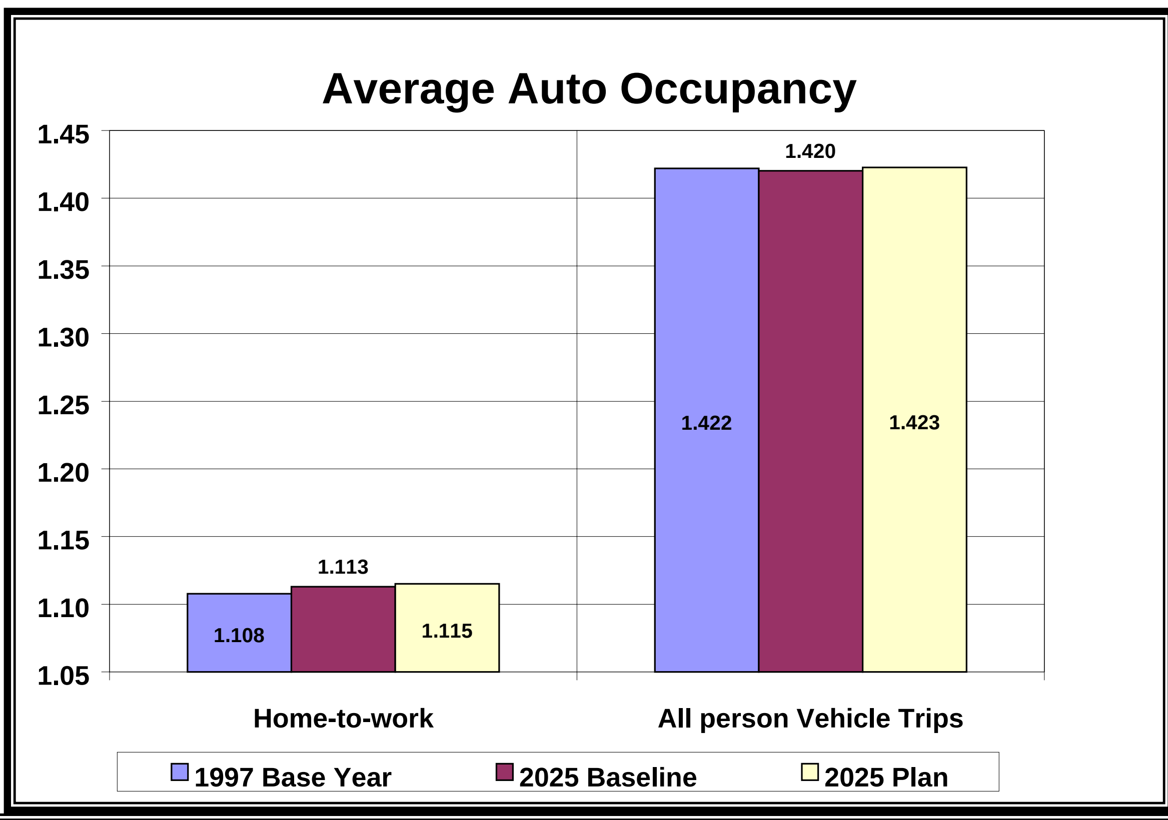

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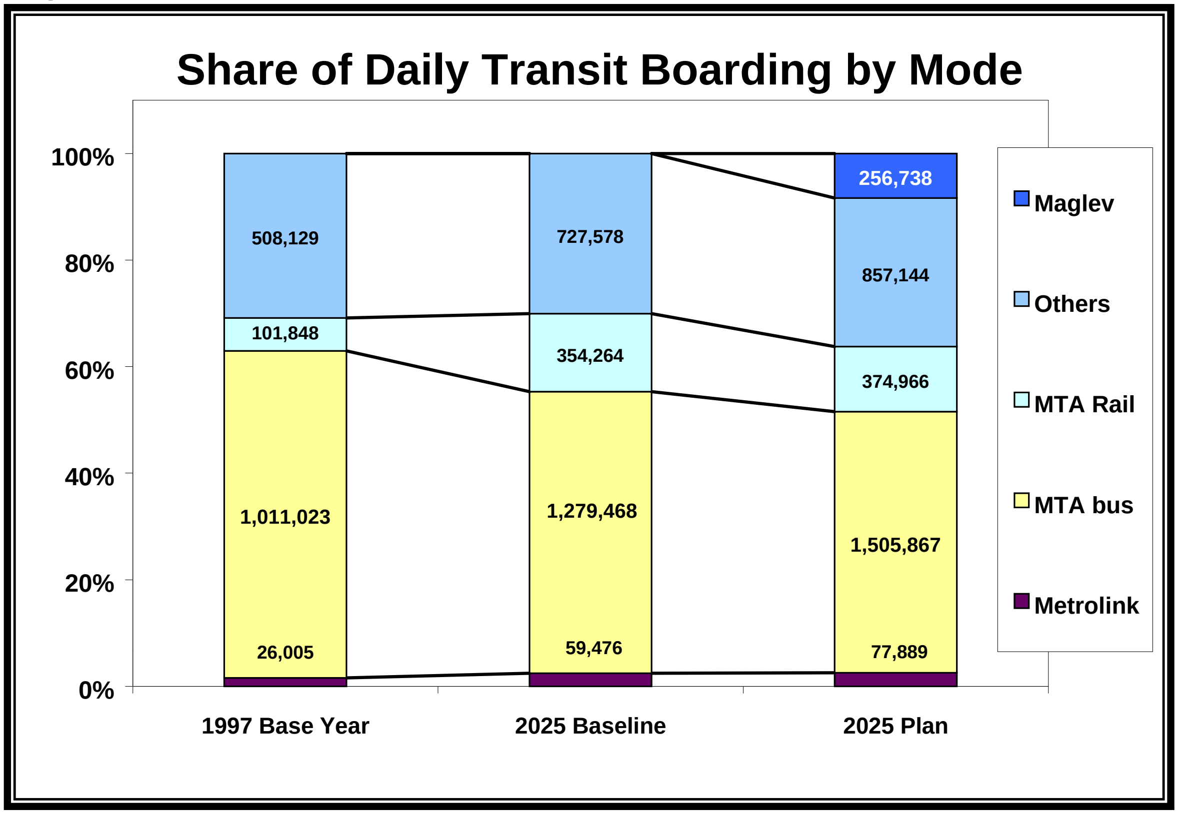

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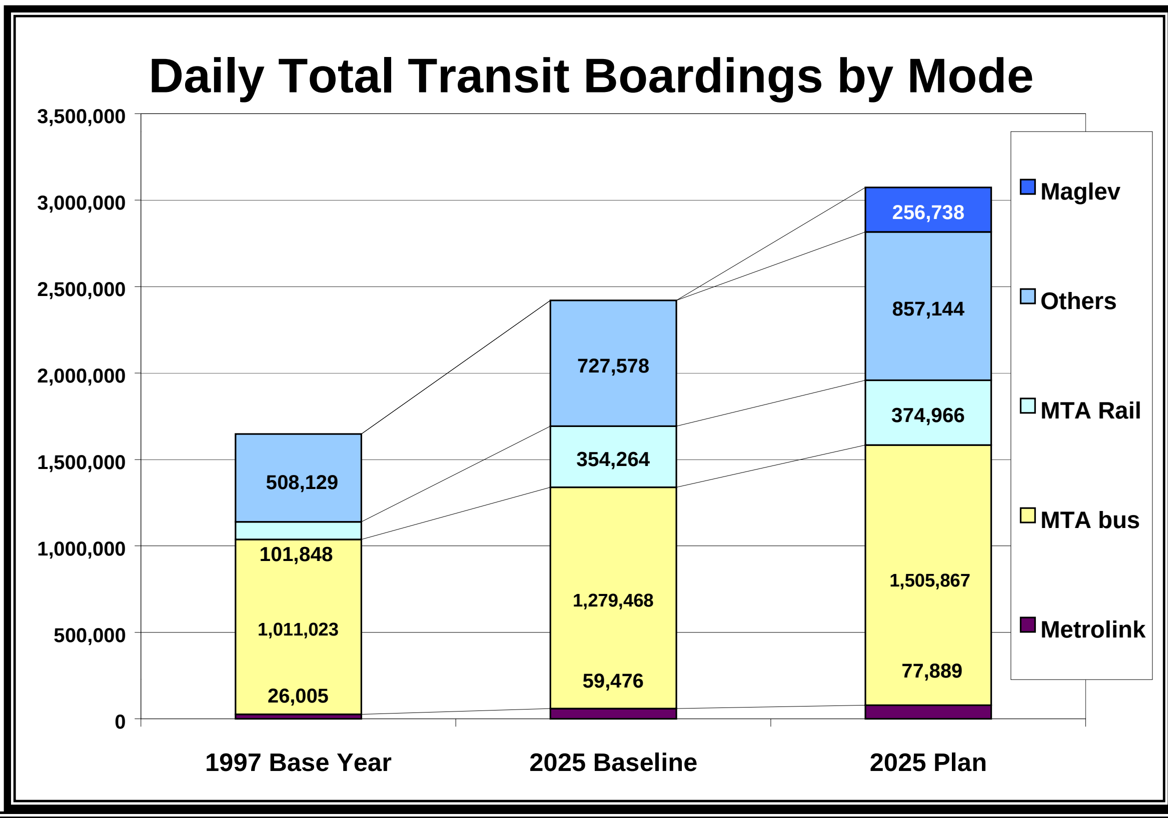


The following sections provide brief descriptions of the methodologies and results of the performance analysis of the 2001 RTP.

Mobility and Accessibility

Mobility captures the speed at which opportunities can be accessed within the region. Opportunities could be jobs as well as other social and recreational opportunities. Measures such as travel time and speed would serve as a mobility indicator. Improvement in mobility would reflect improvement in the transportation system itself. Mobility has been defined as follows.

> *Mobility refers to the ease with which individuals can move about. In addition, mobility pertains to a population in which individuals travel freely because the time and cost of travel are moderate and the travel options are numerous.*

<u>*Technical Definition of Mobility*</u>

Total Person Hours of Travel on Highways (on a per person trip basis).

M = VHT * (AVR / PT) = (VMT / s) * (AVR / PT)
= (T * D) / s * (AVR / PT)

Where
M = Mobility Performance Indicator
VHT = Vehicle Hours Traveled
AVR = Average Vehicle Ridership or the relationship of total person trips taken on all modes or eliminated through working at home or telecommuting
PT = Person Trip
VMT = Vehicles Miles Traveled
s = Weighted operating speed
T = Total Daily Trips
D = Average Travel Distance

> *Accessibility captures the ease with which opportunities can be accessed. Accessibility generally pertains to land uses. Accessibility considers the distribution of "destinations" so that policies might be evaluated – not in terms of moving people to their destinations, but also in terms of moving destinations to people.*

<u>*Accessibility*</u>

Percent of Work Trips within average travel time.
∉# A = f (J, T)

It is assumed that work trips equate to number of jobs. Therefore, accessibility is the Trip Length Frequency Distribution.

A = Accessibility Performance Indicator
J = Job Opportunities
T = Travel Time

The 2001 RTP's performance in terms of mobility and accessibility is depicted in Table J.4. Mobility is measured primarily in terms of work trip travel time, PM peak freeway and non-freeway speeds and percent PM peak travel in delay for freeways and non-freeways. The PM peak time period (3 PM to 7 PM) is chosen as the criteria for evaluation because it typically represents the worst travel condition in any given 24-hour period. Accessibility is measured as the percent of commuters who can get to work within 45 minutes of door-to-door travel time.

Table J.4

Mobility and Accessibility Performance Results	
Performance Indicators	**Improvement from 2025 Baseline to 2025 Plan**
MOBILITY – *Ease of movement people, goods, and services*	
Work Trip Travel Time	7%
PM Peak Highway Speed: Freeway Non-Freeway	 15% 8%
Percent of PM Peak Travel in Delay Freeway Non-Freeway	 14% 19%
ACCESSIBILITY – *Ease of reaching opportunities as measured by the percent of commuters who can get to work within 45 minutes door-to-door travel time*	
Increased Work Trips within: 45 minutes by Auto 45 minutes by Transit	 3% 48%

The improvement in mobility and accessibility identified in Table J.4 are consistent with the Performance Objectives and their targets adopted by the Transportation & Communications Committee for the 2001 RTP as found in Table J.1. These improvements result from the change from baseline conditions in the year 2025 to conditions under Plan implementation. Significant mobility increases are shown across the five factors representing system speed, delay and work trip travel time. The increases come from a weighted summation of transportation model results across vehicle, trip and roadway types. The largest numerical increase is seen with the reduction in percent of travel in delay during the PM peak period, with an average system-wide 16% decrease on the modeling network.

Table J.5

PM Peak Travel in Delay		
	Baseline	**Plan**
PM Peak Hours in Delay (Freeway)	1,350,205	1,014,491
PM Peak VHT (Freeway)	2,576,314	2,250,415
PM Peak Hours in Delay (Non-freeway)	971,630	691,222
PM Peak VHT (Non-freeway)	3,421,399	3,002,561

The work trip travel time reduction of 7%, while numerically smaller, may imply an even more substantial benefit in the region as it reflects work trips throughout the day. Improvements in both the work trip travel time and the travel delay on freeway (14%) and non-freeway (19%) segments are reflected in the increase in average vehicle speeds during the afternoon commuting period, the four-hour PM peak.

Accessibility results are direct model outputs identifying the breakdown of work trips by trip time across mobility modes (see Figures J.44 and J.45). The standard reflects the amount of time that passes from the moment the trip starts, generally from the home, to the end at the place of employment. This door-to-door standard, adopted by the Transportation & Communications Committee, recognizes the importance of capturing the additional time required to walk to and from the transit hub, as well as other forms of intermodal travel. The reduced work trip times identified for the mobility indicator result directly in the increase in commute trips within 45 minutes by auto (3%) and transit (48%).

Figure J.44

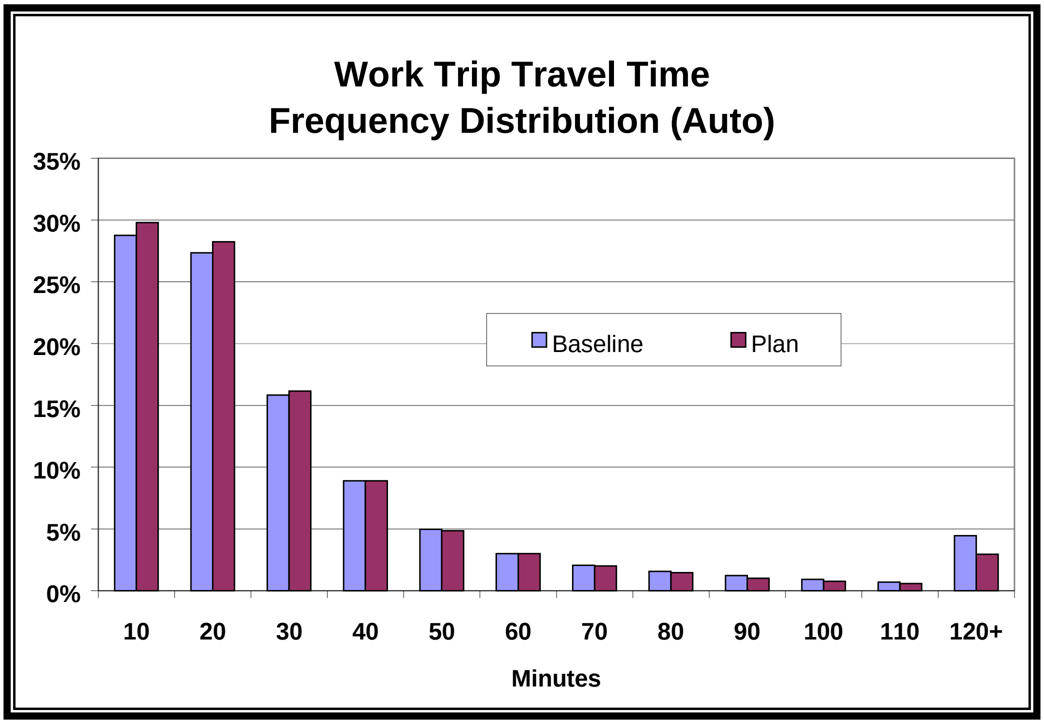
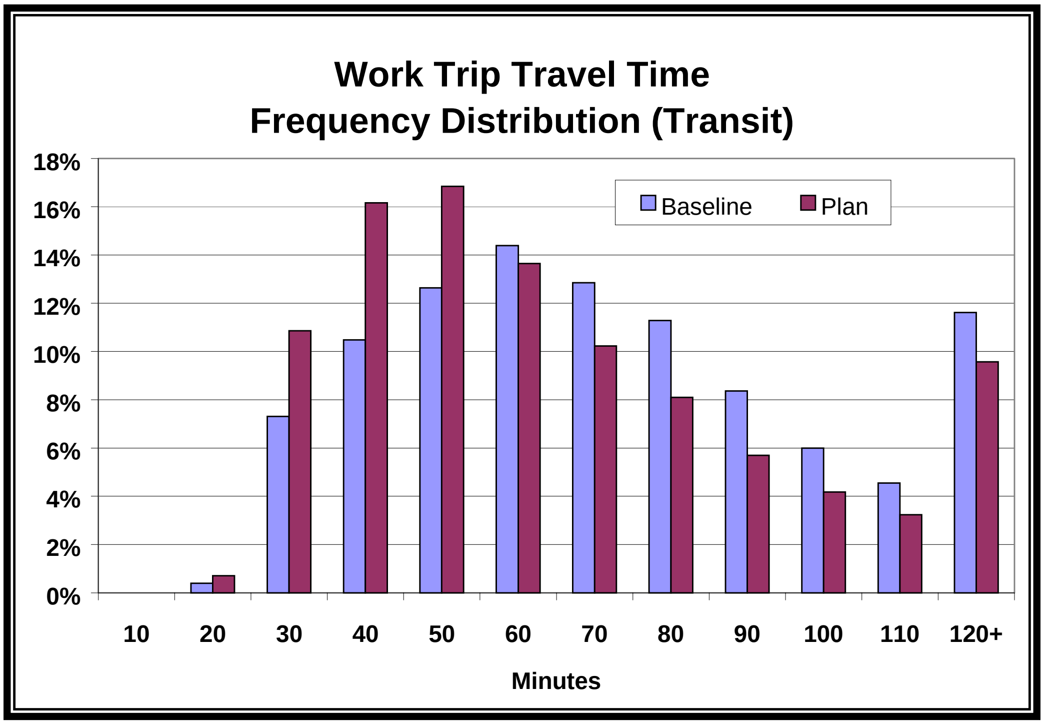


Figure J.45



The 2001 RTP will improve mobility and accessibility benefits significantly over the baseline condition in 2025. Work trip travel time, PM peak speed and PM peak delay all improve with Plan implementation. Greater improvement is seen in freeway travel speed and PM peak delay throughout the roadway system, reflecting the investment mix of highway lane miles and strategic arterial projects. Similarly, accessibility to work identifies vast improvement in transit trips reflecting the substantial investment in transit in the 2001 RTP.

Reliability and Safety

Reliability pertains to on time performance for the transit system. For the highway system, it refers to the probability of arriving at a destination at the expected time.

> *Reliability is the probability of arriving at your destination within the expected time or schedule. Mode choice considerations are greatly linked to the reliability of the highway and transit systems.*

Reliability

```
Probability that the users will arrive at their destinations at
the expected time.
R = 1 - Sum ((% of trips within expected time) - (% of trips
```

The safety criterion pertains to the reduction of fatal and non-fatal accidents depending on the transportation investment choices made.

Safety refers to the physical design and operation of the transportation system. Safety is measured in accidents per person mile for all transportation modes.

<u>*Safety*</u>

```
Fatal and non-Fatal Accidents per Million Person Miles Traveled
(on a Specific Facility).
S = (Fatal + non-Fatal Accidents) / Million Person Miles Traveled

Where:
S = Safety Performance Indicator
Fatal Accidents
non-Fatal Accidents
Person Miles Traveled
```

Reliability is analyzed for transit and highway separately. Reliability for transit is simply on time performance of the service. Reliability for highway is defined as the probability of reaching a destination within the time that it would take to travel under normal flow speed. Safety analysis is provided only for fatal and non-fatal injury accidents for all modes. As shown by the analysis, the Plan does represent an improvement over the baseline (Table J.6).

Table J.6

Reliability and Safety Performance Results	
Performance Indicators	**Plan Improvement Over Baseline**
RELIABILITY – *Reasonably dependable levels of service as measured by the percent of on-time arrivals*	
Transit	3%
Highway	11%
SAFETY – *Transit with minimal risk of accident or injury as measured by reduced accidents*	
Fatality Per Million Passenger Miles	0%
Injury Accidents	0%

Highway reliability reflects the hours spent in delay in comparison to the total number of hours of travel identified by the transportation model. The hours are a weighted summary of model results that can be compared between baseline conditions and Plan conditions in the year 2025. The Plan improves highway reliability by 11% over the baseline in 2025 (Table J.7).

Table J.7

Highway Reliability		
	Baseline	**Plan**
Daily Hours of Delay	2,916,453	2,197,952
Daily VHT	7,151,271	6,436,700
Highway Reliability	**59%**	**66%**

Transit reliability was defined as the percentage of time a specific transit mode arrives within 3-5 minutes of the posted schedule time. Over twenty-five transit agencies within the region were contacted to determine an average reliability rate for each transit mode. The following table represents information received from seventeen transit operators:

Table J.8

Transit Reliability Assumptions	
Local Bus	70%
Express Bus	90%
Rapid Bus	90%
Urban Rail	92%
Metrolink	95%
Maglev*	98%

*Operational assumption based on performance of German prototype

Reliability improvements for all modes from baseline to Plan 2025 were calculated by multiplying the reliability rates by the modal daily boardings. Then, the weighted reliability is summed for all modes and divided by the total daily boardings to calculate the average reliability for all modes (Table J.9). The Plan improves transit reliability by 3% over the baseline in 2025.

Table J.9

Transit Reliability					
Mode	**Reliability**	**2025 Baseline**		**2025 Plan**	
		Total Daily Boardings	**Weighted Reliability**	**Total Daily Boardings**	**Weighted Reliability**
Local Bus	0.70	1,813,023	1,269,116	1,984,299	1,389,009
Express Bus	0.90	95,217	85,695	129,990	116,991
Rapid Bus	0.90	98,811	88,930	248,726	223,853
Metrolink	0.95	59,477	56,503	77,889	73,995
Urban Rail	0.92	354,265	325,924	374,966	344,969
Maglev	0.98	-	-	256,738	251,603
Totals		**2,420,793**	**1,826,168**	**3,072,608**	**2,400,420**
		Avg. Reliability for all Modes	**75.4%**	**Avg. Reliability for all Modes**	**78.1%**

Fatal and injury accident rates were calculated using state and regional data on accident rates per million passenger miles for both auto travel (on freeways and arterials) and transit travel. System-wide accident rates for the region were then calculated for the base year, baseline, and Plan (Table J.10).

Table J.10

Safety Performance Analysis				
Fatal Accidents				
Facility	**Rate per one mil Pass. Miles**	**1997 Base Year Daily Million Pass. Miles**	**2025 Baseline Daily Million Pass. Miles**	**2025 Plan Daily Million Pass. Miles**
Freeway (Auto)	0.0049	255.4	365.4	365.8
Non-Freeway (Auto)	0.0179	185.1	263.6	249.9
Transit – Bus	0.011	6.88	8.13	10.47
Transit – Rail	0.031	0.92	3.15	12.33
System Total Pass. Mi.		448.24	640.3	638.5
System Fatal Acc. Rate		**0.01**	**0.01**	**0.01**
Injury Accidents				
Facility	**Rate per one mil Pass. Miles**	**1997 Base Year Daily Million Pass. Miles**	**2025 Baseline Daily Million Pass. Miles**	**2025 Plan Daily Million Pass. Miles**
Freeway (Auto)	0.19	255.4	365.4	365.8
Non-Freeway (Auto)	0.45	185.1	263.6	249.9
Transit - Bus	1.8	6.88	8.13	10.47
Transit - Rail	0.31	0.92	3.15	12.33
System Total Pass. Mi.		448.24	640.3	638.5
System Injuries Rate		**0.32**	**0.32**	**0.32**

Notes:

1. Auto accident rates are based on Caltrans 1999 accident data on state highways, average of 1997-98-99 data, expressed per million vehicle miles traveled. The average auto occupancy of 1.4 was used to convert auto accidents rates to accidents per million passenger miles traveled.
2. Transit accident rates are based on an average of 1997-98 data reported for SCAG region operators in the National Transit Database.

Cost-Effectiveness/Cost- Benefit Analysis

Cost effectiveness refers to the potential for receiving the greatest return possible on monetary investments into the transportation system.

> *Cost effectiveness refers to the potential for receiving the greatest return possible on investments. The cost effectiveness of investments should be considered from the perspective of the public provider, user, and society.*

Cost-Effectiveness

Investment Returns from service provider, system user and society perspective.

- MSPC = Annualized capital and operating costs per travel hour saved
- MUC = User Cost per person mile (all subsidies are not included)
- SC = Annualized Congestion and Air Pollution Costs

Where:
MSPC = Mobility Service Provider Cost
MUC = Mobility User Cost
SC = Societal Cost
Project Capital Cost
Annualized Operating Costs, including maintenance
Life Cycle
Passenger Mile
Annualized Congestion and Air Pollution Costs

Cost Benefit Analysis: Deriving Net Present Value and the Benefit/Cost Ratio

The purpose of Cost-Benefit Analysis (CBA) is to facilitate the more efficient allocation of society's scarce resources. Because SCAG, like many other Metropolitan Planning Organizations (MPOs) throughout the nation, is faced with the challenge of expanding transportation investment at a time when financial resources are scarce, CBA is critical.

A simple cost-benefit model is utilized to demonstrate the 2001 RTP's efficiency. The costs of the 2001 Plan are compared to the benefits in the form of a ratio of one dollar spent for a certain amount of dollar benefits.

Costs, as analyzed here, include all public expenditures over the life cycle of the project(s) under consideration. Additionally, all benefits assessed are mobility related benefits including delay savings, accident reduction, and air quality benefits. Benefits are assumed to be realized beginning in 2010 when a majority of the projects in the Plan are expected to be completed and in operation. Incrementally increasing amounts of benefits are captured through 2025 and then remain flat through 2040 (an estimated 30-year life span).

Certainly delay savings, accident reduction and air quality benefit measures do not capture all of the social benefits of the 2001RTP. For simplicity, however, these three measures were utilized to assess the Plan benefits. SCAG derived each effectiveness measure by assessing the difference between the 2025 baseline and the 2025 plan. Assumed monetary values for each of these effectiveness measures are further discussed in the following:

Table J.11

Assumptions for Value of Time	
Value of Hour Saved for Passenger Vehicles	**Value of Hour Saved for Trucks**
$8.59[1]	$27.00[2]
(1) Value is assumed to be 50% of average wage rate for the region. According to the Bureau of Labor Statistics, the average wage rate for March of 1998 was $17.69. This average was adjusted to a 1997 estimate of $17.17 using a deflation factor of 3%. (2) An average was estimated based upon recent research and conversations with Caltrans and US DOT.	

Table J.12

Arterial & Freeway Accident Rates with Associated Costs *(Per Million Vehicle Miles)*			
Type of Accident	**Arterial Rate**	**Freeway Rate**	**Cost Per Event**
Fatal	0.025	0.0069	$3,104,738
Injury	0.635	0.2631	$81,572
Property	0.64	0.64	$6,850
Source: Caltrans			

Table J.13

Bus & Rail Accident Rates with Associated Costs *(Per Million Vehicle Miles)*			
Type of Accident	**Bus Rate**	**Rail Rate**	**Cost Per Event**
Fatal	0.162	1.161	$2,710,000
Injury	25.8	11.6	$65,590
Source: Caltrans			

Table J.14

Health Cost of Transportation Emissions For LA/South Coast *(1997$/ton)*				
CO	**NOx**	**PM_{10}**	**Sox**	**VOC**
$105	$42,659	$349,455	$131,294	$2,652
Source: UC Davis Study – McCubbin and Delucchi; Caltrans Cost-Benefit Model				

Public decisions to build transportation projects often have important consequences over an extended period of time. The SCAG region is expected to incur costs and accumulate benefits over a number of years. Because projects with different flows of benefits and costs arise over different time periods, an inter-temporal (across time) analysis is utilized. That is, the mechanics of discounting are used to ensure that future costs and benefits are in a common metric: the present value. The methodology utilized is further discussed in the following.

First, real or constant dollar terms were derived, for both cost and benefit values by adjusting for changes in inflation, assuming a 3 percent deflation factor and using a base year of 1997. These constant dollar values were further discounted by the real discount rate of an estimated 5 percent in order to obtain the Net Present Value (NPV) and in turn, the Benefit/Cost (B/C) ratio in present-value terms. The assumptions used to calculate the NPV and B/C ratios are as follows:

Table J.15

Assumptions Used to Calculate Present Value	
Nominal Discount Rate	8%
Inflation Rate	3%
Real Discount Rate	5%
Note: the nominal discount rate was derived based upon conversations with Caltrans' Economic Planning Department staff and further literature review.	

Table J.16

2001 RTP
Cost-Benefit Analysis

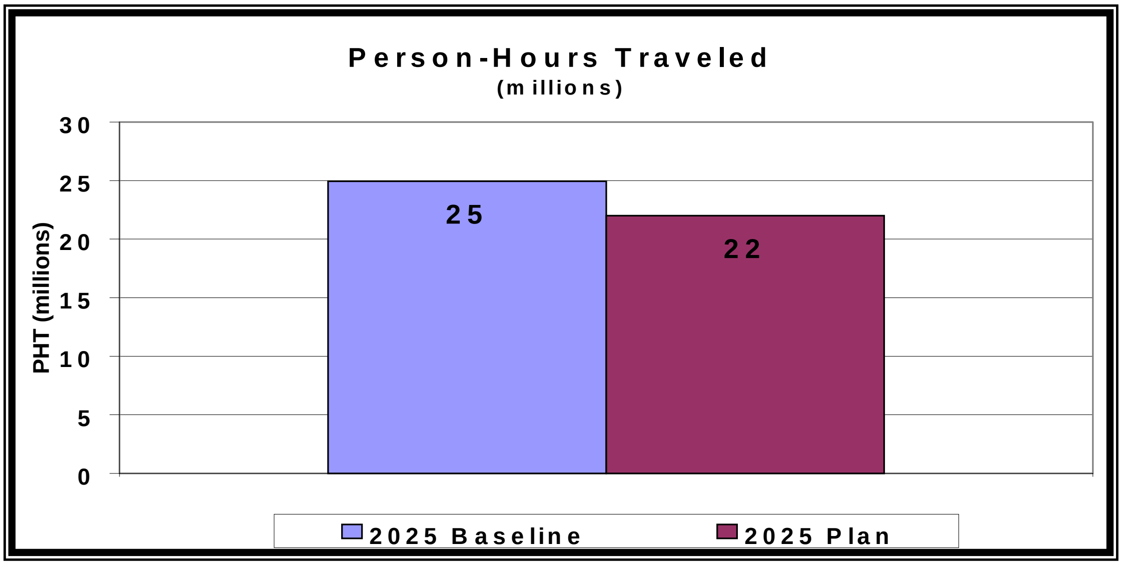
Project	Costs (In Billions)	Benefits (In Billions)	Net Present Value/Net Benefits (In Billions)	Benefit/Cost Ratio (Value of One Dollar Invested)
2001 RTP *(present value)*	$ 10.4	$ 24.7	$ 14.3	$ 2.38
2001 RTP *(constant $)*	$ 24.3	$ 108.0	$ 83.7	$ 4.44

Cost Effectiveness Analysis: Measuring Cost Per Unit of Outcome Effectiveness

In addition to a cost-benefit analysis, SCAG used a cost-effectiveness analysis (CEA) in terms of a cost per unit of outcome effectiveness. This CEA does not assume monetary values of benefits; rather, it involves two different metrics: cost in dollars (constant 1997 dollars) and an effectiveness measure. Cost-effectiveness may provide a more reasonable means of determining the most desirable redistribution possible for some fixed level of net costs.

In this case, the effectiveness measure is the difference in Person Hours Traveled (PHT) between the 2025 baseline and 2025 plan. The change in PHT is presented in the figure below (Figure J.46). Accordingly, CEA results indicate that it costs $2.83 to reduce each person hour traveled.

Figure J.46



Benefit/Cost Ratios of 2001 RTP Investments: Individual Projects

In the 1998 RTP, an extensive benefit analysis was undertaken to determine the mobility and air quality benefits from individual projects. A modeling tool, TRANSCAD, was utilized to isolate the mobility benefits of individual projects to the transportation system. When a project was added to the network, increased vehicle speeds resulted in reduced average vehicle delay in the vicinity. Additionally, the increase in vehicle speeds provided air quality benefits as a result of changed primary pollutant emissions from the tail pipes of those motor vehicles.

The results of analyses in the 1998 RTP have been applied to projects in the 2001 RTP and have been utilized in this section of the Appendix. Ratios are not provided for some goods movement projects such as grade separations and many arterial projects because of the inability to assess the benefits of these specific projects with a regional network model. Unlike the regional B/C analysis as discussed in the above sections, the results of this B/C analysis for individual projects include the value of air quality and mobility benefits, and not the value of reduced accidents. The B/C ratios of regionally significant projects are provided for the 2001 RTP investments (Table J.17).

Table J.17

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
MIXED FLOW								
IM	SR-7	I-8 to SR-115	Expressway	2010	$13,000,000	$19,500,000	$6,500,000	1.5
IM	SR-98	SR-111 to new SR-7	Expressway	2010	$23,000,000	$34,500,000	$11,500,000	1.5
IM	SR-111	SR-98 to I-8	Expressway	2010	$23,000,000	$34,500,000	$11,500,000	1.5
IM	SR-111	SR-78 to SR-111/SR-115	Expressway	2010	$10,000,000	$15,000,000	$5,000,000	1.5
IM	SR-115	Evan Hewes Hwy to SR-78	Expressway	2010	$35,000,000	$52,500,000	$17,500,000	1.5
HOV								
LA	SR-14	Ave. P-8 to Ave. L	Freeway: HOV	2015	$23,000,000	$46,000,000	$23,000,000	2
LA	I-710	I-10 to Huntington Dr	Freeway: HOV	2010	$92,000,000	$184,000,000	$92,000,000	2
LA	I-710	Huntington Dr to I-210	Freeway: HOV	2025	$137,000,000	$274,000,000	$137,000,000	2
LA	I-5/I-405	North to South/South to North	HOV Connector	2025	$73,000,000	$146,000,000	$73,000,000	2
LA	I-5/SR-170	North to South/South to North	HOV Connector	2025	$37,000,000	$74,000,000	$37,000,000	2
LA	I-405	US-101 to Burbank Blvd (NB)	Freeway: HOV	2010	$3,000,000	$6,000,000	$3,000,000	2
MIXED FLOW								
LA	I-710	I-10 to Huntington Dr	Freeway: Mixed Flow	2010	$274,000,000	$548,000,000	$274,000,000	2
LA	I-710	Huntington Dr to I-210	Freeway: Mixed Flow	2025	$412,000,000	$824,000,000	$412,000,000	2
LA	I-5	Rosecrans to Or Co Line	Freeway: Mixed Flow	2010	$110,000,000	$220,000,000	$110,000,000	2
LA	I-5 Interchanges	Orange County to Rosemead Blvd	Interchanges	2025	$181,000,000	$362,000,000	$181,000,000	2

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
LA	SR-57/SR-60		Interchanges	2025	$181,000,000	$362,000,000	$181,000,000	2
TRANSIT								
LA	Metrolink Improvements	Future Improvements	Commuter Rail	2025	$346,000,000	$692,000,000	$346,000,000	2
LA	Vermont		Rapid Bus	2010	$65,000,000	$195,000,000	$130,000,000	3
LA	Venice & Pico/East 1st		Rapid Bus	2010	$152,000,000	$456,000,000	$304,000,000	3
LA	Van Nuys		Rapid Bus	2010	$98,000,000	$294,000,000	$196,000,000	3
LA	Crenshaw-Rossmore		Rapid Bus	2010	$98,000,000	$294,000,000	$196,000,000	3
LA	Avalon		Rapid Bus	2010	$79,000,000	$237,000,000	$158,000,000	3
LA	Florence		Rapid Bus	2010	$131,000,000	$393,000,000	$262,000,000	3
LA	Santa Monica		Rapid Bus	2010	$90,000,000	$270,000,000	$180,000,000	3
LA	Western		Rapid Bus	2010	$82,000,000	$246,000,000	$164,000,000	3
LA	Long Beach Ave		Rapid Bus	2010	$96,000,000	$288,000,000	$192,000,000	3
LA	Hawthorne		Rapid Bus	2010	$77,000,000	$231,000,000	$154,000,000	3
LA	Hollywood-Pasadena		Rapid Bus	2010	$78,000,000	$234,000,000	$156,000,000	3
LA	Soto		Rapid Bus	2010	$55,000,000	$165,000,000	$110,000,000	3
LA	San Fernando Rd		Rapid Bus	2010	$102,000,000	$306,000,000	$204,000,000	3
LA	West Third		Rapid Bus	2010	$32,000,000	$96,000,000	$64,000,000	3
LA	Hollywood-Fairfax		Rapid Bus	2010	$39,000,000	$117,000,000	$78,000,000	3
LA	Alvarado		Rapid Bus	2010	$25,000,000	$75,000,000	$50,000,000	3
LA	Garvey		Rapid Bus	2010	$62,000,000	$186,000,000	$124,000,000	3
LA	Century Blvd		Rapid Bus	2010	$47,000,000	$141,000,000	$94,000,000	3
LA	Vernon-La Cienega		Rapid Bus	2010	$80,000,000	$240,000,000	$160,000,000	3
LA	Roscoe		Rapid Bus	2010	$106,000,000	$318,000,000	$212,000,000	3
LA	Atlantic		Rapid Bus	2010	$92,000,000	$276,000,000	$184,000,000	3
LA	San Fernando Valley North/South Corridor		Rapid Bus	2010	$102,000,000	$306,000,000	$204,000,000	3

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
LA	Crenshaw Corridor		Rapid Bus	2010	$173,000,000	$519,000,000	$346,000,000	3
TRUCK LANES								
LA	SR-60	SR-710 to SB Co Line	Truck Lanes	2010	$2,374,000,000	$11,870,000,000	$9,496,000,000	5
HOV								
OR	I-5	SR-1 to Pico	Freeway: HOV	2020	$70,000,000	$70,000,000	$0	1
OR	SR-55	I-5 to Dyer, NB and SB	Extend I-5/SR-55 HOV connector to Dyer as separate HOV lane	2010	$40,000,000	$40,000,000	$0	1
OR	SR-22 @ I-5	SR-22 @ I-5	HOV Connector	2025	$66,000,000	$66,000,000	$0	1
OR	SR-22 @ SR-55	SR-22 @ SR-55	HOV Connector	2025	$63,000,000	$63,000,000	$0	1
OR	I-405 @ SR-22	I-405 @ SR-22	HOV Connector	2010	$60,000,000	$60,000,000	$0	1
OR	I-605 @ I-405	I-605 @ I-405	HOV Connector	2010	$85,000,000	$85,000,000	$0	1
OR	I-405 HOV Drop Ramps	@ Von Karman	HOV Drop Ramps	2025	$24,000,000	$24,000,000	$0	1
MIXED FLOW								
OR	I-405, NB & SB	Magnolia Avenue to Beach Blvd.	Auxiliary Lanes	2010	$8,000,000	$16,000,000	$8,000,000	2
OR	SR-55	I-5 to McArthur Blvd	Auxiliary Lanes	2010	$40,000,000	$80,000,000	$40,000,000	2
OR	SR-57	LA Co Line to SR-22	Add NB Aux Lane from Katella to SR-91 and from Orangethorpe to Imperial Hwy; Add SB Aux Lane from LA County to SR-91; Add NB Truck Climbing Lane from Lambert to Tonner	2010	$186,000,000	$744,000,000	$558,000,000	4
OR	SR-91	SR-57 to I-5 (WB only)	Auxiliary Lanes	2020	$15,000,000	$30,000,000	$15,000,000	2
OR	SR-91 WB	SR-55 to Tustin Ave	Auxiliary Lanes	2010	$25,000,000	$50,000,000	$25,000,000	2
OR	SR-91	SR-241 to SR-71	Auxiliary Lanes	2025	$7,000,000	$7,000,000	$0	1
OR	SR-91 Freeway	Between SR-71 (Riv County) and Coal	Auxiliary Lane (WB)	2006	$5,000,000	$10,000,000	$5,000,000	2

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
		Canyon						
OR	I-5 NB & SB	I-5 La Paz to Oso	Add auxiliary lane, widen bridge, intersection improvements	2010	$13,000,000	$26,000,000	$13,000,000	2
OR	I-5, NB & SB	at La Paz Road	Reconstruct interchange	2010	$30,000,000	$60,000,000	$30,000,000	2
OR	I-5, SB	at Alicia Parkway	Auxiliary Lane	2010	$2,000,000	$4,000,000	$2,000,000	2
OR	I-5, SB	at Jamboree	Provide two lane off-ramp and widen terminal section of off-ramp	2010	$3,000,000	$6,000,000	$3,000,000	2
OR	I-5, SB	at Culver Drive	Widen off-ramp to 2 lanes	2010	$1,000,000	$2,000,000	$1,000,000	2
OR	SR-91, WB	Lakeview @ SR-91	Reconfigure ramp	2010	$8,000,000	$16,000,000	$8,000,000	2
OR	SR-91, EB	Truck scales to Imperial Hwy	Add truck storage lane	2010	$1,000,000	$2,000,000	$1,000,000	2
OR	I-5, SB	I-5 between 1st and SR-55	Operational Improvements	2020	$50,000,000	$100,000,000	$50,000,000	2
OR	I-5/SR-74	I-5/SR-74 Separation	Interchange Improvement	2020	$30,000,000	$60,000,000	$30,000,000	2
OR	I-5, NB & SB	Avery Parkway	Interchange Improvement	2020	$18,000,000	$27,000,000	$9,000,000	1.5
OR	I-405, NB	NB I-405 - @ Culver and Sand Canyon	Add auxiliary lanes, extend right lanes to tie with merge lanes	2020	$12,000,000	$18,000,000	$6,000,000	1.5
OR	I-5/I-405, NB	Alicia Parkway to Sand Canyon	Add auxiliary lane; signing & striping improvements	2020	$2,000,000	$2,000,000	$0	1
OR	Countywide	Other Chokepoints Countywide	Fix Freeway Chokepoints that cause bottlenecks	TBD	$643,000,000	$1,929,000,000	$1,286,000,000	3

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
TRANSIT								
OR	Commuter Rail	Countywide	Track and Stations (Per SCRRA Long Range Plan)	2010	$270,000,000	$270,000,000	$0	1
OR	Garden Grove Blvd		Rapid Bus	2010	$110,000,000	$220,000,000	$110,000,000	2
OR	Katella Ave		Rapid Bus	2010	$110,000,000	$220,000,000	$110,000,000	2
OR	Bolsa Ave/1st St		Rapid Bus	2010	$110,000,000	$220,000,000	$110,000,000	2
OR	Harbor Blvd		Rapid Bus	2010	$110,000,000	$220,000,000	$110,000,000	2
OR	Bristol St		Rapid Bus	2010	$110,000,000	$220,000,000	$110,000,000	2
OR	Main St		Rapid Bus	2010	$110,000,000	$220,000,000	$110,000,000	2
OR	Intermodal Center	Anaheim	Transit Center	2025	$50,000,000	$100,000,000	$50,000,000	2
HOV								
RIV	I-15	SB Co Line to SR-91	Freeway: HOV	2020	$43,000,000	$43,000,000	$0	1
RIV	I-215	Ramona Exwy to EJ SR-60/I-215	Freeway: HOV	2025	$41,000,000	$41,000,000	$0	1
RIV	I-215	SR-60/I-215/SR-91 IC to SB Co Line	Freeway: HOV	2020	$60,000,000	$60,000,000	$0	1
RIV	SR-60/I-215	60/215 E Jct east to SR-60	HOV Connector	2010	$33,000,000	$33,000,000	$0	1
RIV	SR-60/I-216	60/215 E Jct south to I-215	HOV Connector	2025	$7,000,000	$7,000,000	$0	1
RIV	I-215	I-15 to S/O Nuevo	Freeway: Mixed Flow & HOV	2025	$82,000,000	$164,000,000	$82,000,000	2
RIV	SR-71	SB Co Line to SR-91	Freeway: Mixed Flow & HOV	2015	$100,000,000	$200,000,000	$100,000,000	2
MIXED FLOW								
RIV	I-15	SR-91 to SR-60	Freeway: Mixed Flow	2020	$40,000,000	$120,000,000	$80,000,000	3
RIV	I-215	Eucalyptus to Columbia	Freeway: Mixed Flow	2025	$75,000,000	$225,000,000	$150,000,000	3
RIV	I-10	Monterey to Dillon	Freeway: Mixed Flow	2010	$40,000,000	$160,000,000	$120,000,000	4
RIV	SR79	Ramona Expwy to	Expressway: Mixed	2010	$130,000,000	$390,000,000	$260,000,000	3

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
		Newport Rd	Flow					
RIV	Riverside/San Bernardino Corridor	San Bernardino to Moreno Valley		2025	$350,000,000	$1,050,000,000	$700,000,000	3
RIV	Corridor	Hemet to Corona/Lake Elsinore		2025	$400,000,000	$1,200,000,000	$800,000,000	3
RIV	Corridor	Banning/Beaumont to Temecula		2025	$650,000,000	$1,950,000,000	$1,300,000,000	3
TRANSIT								
RIV	Metrolink Improvements	Countywide	Commuter Rail	2025	$184,000,000	$368,000,000	$184,000,000	2
RIV	San Jacinto Commuter Rail	4th & D St to 7th & State St	Commuter Rail	2020	$63,000,000	$94,500,000	$31,500,000	1.5
TRUCK LANES								
RIV	I-15	SB County Line to SR-60	Truck Lanes	2020	$40,000,000	$200,000,000	$160,000,000	5
RIV	SR-60	SB Co Line to I-15	Truck Lanes	2010	$40,000,000	$200,000,000	$160,000,000	5
HOV								
SB	I-215	SR-30 to I-15	Freeway: Mixed Flow & HOV	2025	$80,000,000	$120,000,000	$40,000,000	1.5
SB	I-10	I-15 to SR-38	Freeway: HOV	2020	$111,000,000	$166,500,000	$55,500,000	1.5
SB	I-10	Yucaipa Bl to Riverside Co. Line	Freeway: HOV	2025	$19,000,000	$19,000,000	$0	1
SB	I-15	Riv Co Line to I-215	Freeway: HOV	2025	$81,000,000	$81,000,000	$0	1
SB	I-15	I-215 to US-395	Freeway: HOV	2020	$95,000,000	$95,000,000	$0	1
SB	I-15	US-395 to D St	Freeway: HOV	2020	$62,000,000	$62,000,000	$0	1
SB	I-215	Riv CL to I-10	Freeway: HOV	2010	$117,000,000	$234,000,000	$117,000,000	2
SB	I-10/I215	South to East/East to South - Freeway HOV Connectors	HOV Connector	2025	$13,000,000	$13,000,000	$0	1
SB	I-10/I-15	South to West/West to South - Freeway	HOV Connector	2025	$12,000,000	$12,000,000	$0	1

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
		HOV Connectors						
SB	I-10/I-15	North to West/West to North - Freeway HOV Connectors	HOV Connector	2025	$12,000,000	$12,000,000	$0	1
MIXED FLOW								
SB	SR-18	LA Co Line to US 395	Expressway: Mixed Flow	2020	$22,000,000	$44,000,000	$22,000,000	2
SB	SR-18	I-15 to Thunderbird	Expressway: Mixed Flow	2020	$10,000,000	$20,000,000	$10,000,000	2
SB	SR-30	Highland to I-10	Freeway: Mixed Flow	2020	$34,000,000	$68,000,000	$34,000,000	2
SB	SR-38	Redlands City Limit (W) to Redlands City Limit (E)	Expressway: Mixed Flow	2020	$5,000,000	$10,000,000	$5,000,000	2
SB	SR-58	Kern County Line to I-15	Freeway: Mixed Flow	2010	$171,000,000	$513,000,000	$342,000,000	3
SB	SR-62	Fairway Dr to SR-247	Expressway: Mixed Flow	2020	$6,000,000	$12,000,000	$6,000,000	2
SB	SR-83	Merril Av to Kimball Av	Expressway: Mixed Flow	2010	$1,000,000	$2,000,000	$1,000,000	2
SB	SR-138	I-15 to L.A. Co. Line	Expressway: Mixed Flow	2010	$23,000,000	$46,000,000	$23,000,000	2
SB	SR-142	Carbon Canyon Rd to Pipeline Dr	Expressway: Mixed Flow	2020	$3,000,000	$6,000,000	$3,000,000	2
SB	SR-247	North of SR-62 to Griffis Rd	Expressway: Mixed Flow	2020	$3,000,000	$6,000,000	$3,000,000	2
SB	US-395	Junction I-15 to Junction SR-18	Freeway: Mixed Flow	2020	$85,000,000	$255,000,000	$170,000,000	3
SB	US-395	Junction SR-18 to 0.6 mi N/O Desert Flower Rd.	Freeway: Mixed Flow	2020	$113,000,000	$339,000,000	$226,000,000	3
SB	I-15	Duncan Canyon Rd in Fontana	New Interchange	2010	$19,000,000	$38,000,000	$19,000,000	2
SB	I-215	Barton Road in	Widen over-crossing	2010	$1,000,000	$2,000,000	$1,000,000	2

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
		Grand Terrace	2-4 lanes					
SB	I-15	Oak Hill Rd in SB County	Replace Overcrossing	2010	$1,000,000	$1,000,000	$0	1
SB	I-15	Stoddard Wells Rd in Victorville	Interchange	2010	$14,000,000	$14,000,000	$0	1
SB	East -West High Desert Corridor - Falchion/Rancho		4	2020	$90,000,000	$360,000,000	$270,000,000	4
SB	SR-18/SR-330	see constrained list	various intersection improvement/realignment	2020	$56,000,000	$56,000,000	$0	1
SB	I-15, I-10, I-215	see constrained list	various interchange	2020	$140,000,000	$140,000,000	$0	1
SB	I-15, I-10, I-215, SR-30	see constrained list	various interchange	2025	$112,000,000	$112,000,000	$0	1
TRANSIT								
SB	Commuter Rail	Countywide	Commuter Rail	2025	$482,000,000	$964,000,000	$482,000,000	2
SB	Local Transit Service	Countywide	Local Transit Service	2025	$314,000,000	$314,000,000	$0	1
SB	Elderly Handicapped Assistance	Countywide	Elderly Handicapped Assistance	2025	$118,000,000	$118,000,000	$0	1
TRUCK LANES								
SB	I-15	Riv Co Line to US 395	Truck Lanes	2020	$622,000,000	$2,488,000,000	$1,866,000,000	4
SB	SR-60	LA Co Line to Riv Co Line	Truck Lanes	2010	$550,000,000	$3,300,000,000	$2,750,000,000	6
SB	I-15	Devore to Summit	Truck Climbing Lane	2010	$9,000,000	$45,000,000	$36,000,000	5
MIXED FLOW								
VEN	SR-33 (Casitas Bypass)	Foster Park to Creek Rd	Expressway: Mixed Flow	2020	$45,000,000	$135,000,000	$90,000,000	3
VEN	SR-118	Tapo Canyon to New LA Ave.	Freeway: Mixed Flow	2015	$66,000,000	$198,000,000	$132,000,000	3
VEN	SR-118 (Moorpark Bypass)	West C.L. to New L.A. Ave	Freeway: Mixed Flow	2015	$46,000,000	$138,000,000	$92,000,000	3

Benefit-Cost Ratios of 2001 RTP Investments: Individual Projects

County	Route	Project Limits	Description	Year	Public Cost	Benefits	Net Benefits	Value of $1 Invested*
VEN	SR-118	SR-232 to Moorpark	Expressway: Mixed Flow	2015	$90,000,000	$270,000,000	$180,000,000	3
VEN	US-101	La Conchita to Mussel Shoals	Interchange Improvement	2005	$15,000,000	$30,000,000	$15,000,000	2
TRANSIT								
VEN	Transit Service Expansion	Countywide	Transit Services	2025	$325,000,000	$325,000,000	$0	1
VEN	Metrolink Service Expansion	Ventura to LA Co. Line	Commuter Rail	2020	$116,000,000	$232,000,000	$116,000,000	2
VEN	Tunnel 26	Countywide	Rail Tunnel Reconstruction	2005	$16,000,000	$16,000,000	$0	1
VEN	Coast Main Line	Countywide	Enhanced Metrolink Capital Maint.	2025	$45,000,000	$90,000,000	$45,000,000	2

* Value of $1 invested in constant 1997 dollars.

Economic Impact Analysis

The purpose of this analysis is to determine the economic impacts of the 2001 Regional Transportation Plan (RTP) utilizing the SCAG Input-Output (I-O) model. The 2001 RTP Constrained Project List contains a wide variety of transportation investment projects including: arterials, grade crossing improvements, high occupancy vehicle (HOV) lanes, mixed flow lanes, hot lanes/tollways, operating and maintenance expenditures, transit, bikeways, park and ride lots, intelligent transportation systems (ITS), truck lanes, commuter rail, high speed rail and others. The constrained project list includes a total of $24.3 billion of publicly funded projects.

The 2001 RTP also includes a number of transportation projects that are intended to be funded by the private sector. These projects are estimated to cost approximately $20.4 billion during the planning period. The privately funded projects are expected to include: hot lanes/tollways, truck lanes and high speed rail.

The economic impacts from private-sector funded projects are different from those financed by tax dollars. Since transportation projects funded by sales and gasoline tax revenues are an extension of past economic trends, most of their impacts are reflected in the baseline employment growth forecast. Private sector involvement in transportation investment represents economic activities not captured by past trends, and as a result will work to boost economic and employment growth higher than the baseline forecast.

The public and private sector funded transportation investment projects will have both positive and negative impacts on the economy. The analysis compares differences in mobility levels and impacts expected from implementation of the 2001 RTP in 2025 with those under the 2025 baseline forecast. This study will focus on the recommended strategy and provide a range of economic impacts resulting from the implementation of the investment projects contained in the strategy. The analysis for the private sector funded projects will focus on the estimation of possible economic and job impacts during the construction phase of the projects.

Elements of Economic Impact Analysis

The major components of the RTP that will affect the economy are expenditures, revenue sources in terms of taxes collected, transportation quality improvements (such as reductions in delay, auto operating and maintenance costs, accidents) and environmental quality (primarily air quality improvement). Despite projected expenditures under the baseline scenario, environmental quality and mobility will remain a serious problem in 2025. The gradual increase in congestion level in the SCAG region will likely have the following impacts:

- Increased vehicle (auto and trucks) related travel costs including maintenance and fuel costs due to increases in both vehicle miles traveled (VMT) and vehicle hours traveled (VHT)
- Monetary loss due to additional travel time for all commuters and vehicles
- Increase in non-recurring congestion primarily due to higher accident rates
- Air quality impacts.

Methodology and Assumptions

Table J.14 shows the breakdown of costs/benefits of each of the individual items included in the analysis. A brief discussion of the data sources, technical assumptions, and estimated unit value is found below:

Air Quality Benefits

The SCAQMD in its 1997 AQMP Socio-economic Report (August 1996) estimated the final average annual benefits for the 1997 AQMP (figures in 1993 dollars):

ü Reduction in Morbidity	$79 million
ü Reduction in Mortality	$47 million
ü Increase in Crop Yields	$33 million
ü Visibility Improvement	$473 million
ü Reduced Materials Expenditures	$156 million

The 2001 RTP will help the region to capture portions of the air quality benefits listed above. The analysis focuses on the portion of the total emission reduction that is attributable to on-road mobile sources. Appendix III of the 1997 AQMP, The Base and Future Year Emission Inventories (August 1996) was used to estimate the emission reduction share from on-road mobile sources. The estimated share of benefits attributable to mobile sources is 40%. The impacts in the analysis were updated to 1997 dollars.

Cost of Accidents

Compared with the 2025 baseline scenario, the 2001 RTP will reduce over 10 million vehicle miles (VMT) of travel per day, which will reduce the accident rate and associated costs. The U.S. DOT weighted average accident costs of police-reported crashes by six highway functional classes reported in dollars per 1,000 VMT was used for this analysis (Table 4-19, Costs of Police –Reported Crashes by Highway Functional Class, from Characteristics of Urban Transportation Systems, Federal Transit Administration, September 1992). The accident costs estimated by the DOT include medical services, ancillary services, emergency services, lost wages, lost household production, lost quality of life, work place disruption, insurance administration, legal and court costs, travel delay for uninvolved motorists, and property value damages. The weighted average accident costs per 1,000 VMT was calculated to be $137.40 in 1990 dollars (updated to 1997 dollars for the analysis).

Infrastructure Investment and Revenue Sources

The 2001 RTP Constrained Project List and the cost for each of its components are used for the analysis. The total public investment that was entered into the IMPLAN input-output model was $24.3 billion. The total private investment that was utilized was $20.4 billion. Capital costs are expenditures on investment projects designed to improve the regional transportation system that are expected to have a positive impact on the regional economy. It is assumed that these investments will raise final demand via expenditures on the construction sector and related industries. There are also major costs incurred in the RTP to maintain the huge investment in facilities. The economic impact of these sectors can be measured primarily by increasing final demand in related sectors.

Major funding sources for the RTP are gasoline taxes, sales taxes, fees, and fares, all of which will eventually be passed on to households. Higher tax payments mean less disposable income for households to buy goods and services. It is assumed that each incremental dollar of taxes and fees paid by an individual implies a reduction of the same amount of household consumption expenditures.

Value of Time

The dollar value of travel time delay is a complex subject that has been subject to considerable debate. There is general consensus, however, that the unit value of travel time delay varies with trip type, length of trip, trip makers' income levels, etc. Previously estimated functions were used to derive the unit value of time savings/delay. The value of time that was used to treat their total travel time as a unit and assign it a dollar value. The calculation of the value of time includes work travel time, work distance and speed. The modeling results indicated that the 2025 RTP would result in the reduction of over one million vehicle hours traveled daily. This was multiplied by the difference in the value of time in order to determine the daily and annual cost savings ($166 million annually).

Auto Operation Costs Associated with VHT and VMT

Vehicle operation costs/expenditures will increase due to due factors: 1.) VMT increase and 2.) congestion build-up. As a result increases in unit vehicle operating and maintenance costs are a function of VMT and speed. The second part of the analysis deals with speed, VMT and increases in out of pocket vehicle costs. The 10 million daily VMT reduction was multiplied by the difference in out of pocket costs in order to determine the cost savings due to VMT reduction. There will also be negative impacts on other economic sectors as a result of the VMT reduction.

IMPLAN INPUT-OUTPUT MODEL

IMPLAN (IMpact Analysis for Planning) was originally developed by the USDA Forest Service in cooperation with the Federal Emergency Management Agency and the USDI Bureau of Land Management to assist the Forest Service in land and resource management planning. The IMPLAN system has been in use since 1979 and evolved from a main-frame, non-interactive application that ran in "batch" mode to a menu-driven microcomputer program that is completely interactive.

There are two components to the IMPLAN system, the software and the database. The software performs the necessary calculations using the study area data to create the models. It also provides an interface for the user to change the region's economic description, create impact scenarios and introduce changes to the local model. The software was designed to serve three functions: data retrieval, data reduction and model development and impact analysis.

The databases provide all the information needed to create regional IMPLAN models. The IMPLAN database consists of two major parts: 1.) national level technology matrices and 2.) estimates of regional data for institutional demand and transfers, value-added, industry output and employment for each county in the U.S. as well as state and national totals. The IMPLAN data and accounts follow the accounting conventions used in the "Input-Output Study of the U.S. Economy" by the Bureau of Economic Analysis (1980) and the rectangular framework recommended by the United Nations. SCAG staff utilized the individual IMPLAN models for each of the SCAG region counties in order to construct a regional model.

The IMPLAN model evaluates the following types of economic effects: direct, indirect and induced. Direct effects are the changes in industries to which a final demand change was made (i.e direct investment in road construction, etc.). Indirect effects are the changes in inter-industry purchases as they respond to the demands of the directly affected industries. Induced effects typically reflect changes in spending from households as income increases or decreases due to the changes in production.

The following types of direct, indirect and induced effects are analyzed by the IMPLAN model: output, value added and employment. Output is the value of production by industry within a given time period. Value added consists of four components: employee compensation, proprietor income, other property income and indirect business taxes. Employment represents the number of full-time equivalent jobs.

The first step in the analysis was to determine the IMPLAN sector in which the change in final demand would occur. The direct investment in each of the 528 IMPLAN sectors must be determined. In most cases this involves only a few sectors. However, in some instances where only general sectors are known they must be distributed over a variety of specific sectors.

In a number of impact categories, it is only known that there would be a change in household consumption. The IMPLAN model utilizes national personal consumption expenditures (PCE) which consist of payments by individuals/households to industries for goods and services used for personal consumption. The national PCE data are distributed to state and counties based on the number of households and household income.

Economic Impacts

The RTP Economic Impact Analysis evaluated the impacts of the following: air quality (positive and negative), accident reduction (positive and negative), publicly funded investment, reduction in vehicle hours traveled, reduction in vehicle miles traveled (positive and negative) and taxes and fees. The 2001 RTP would result in a net positive economic impact (direct, indirect and induced) of $2.1 billion in output, $0.9 billion in value added and 21,700 jobs.

The positive and negative effects were categorized and entered into the appropriate sectors of the IMPLAN input-output model. The results are summarized in Table J.18.

Table J.18

2001 RTP – DIRECT, INDIRECT, AND INDUCED ANNUAL IMPACTS OUTPUT, VALUE ADDED, EMPLOYMENT (millions of 1997 dollars)

IMPACT CATEGORY	OUTPUT				VALUE ADDED				EMPLOYMENT			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Air Quality	$304.0	$55.3	$42.7	$402.0	$129.6	$33.8	$27.0	$190.4	2,005	562	522	3,089
Accidents	$0.0	-$31.5	-$96.5	-$128.0	-$95.1	-$25.6	-$61.4	-$182.1	-752	-568	-1,182	-2,502
Public Funded Projects	$874.3	$351.7	$310.9	$1,536.9	$381.5	$195.6	$197.8	$774.9	9,575	3,206	3,805	16,586
Vehicle Hours Traveled	$166.1	$51.8	$65.7	$283.6	$109.6	$31.8	$41.6	$183.0	3,406	549	802	4,757
Vehicle Miles Traveled	$0.0	-$52.9	-$32.9	-$85.8	$2.2	-$25.6	-$21.0	-$44.4	74	-409	-404	-739
Taxes and Fees	-$857.0	-$173.9	-$189.5	-$1,220.4	-$375.5	-$106.2	-$120.6	-$602.3	-7,343	-1,781	-2,319	-11,443
Private Funded Projects	$727.1	$313.1	$242.7	$1,282.9	$278.2	$174.0	$154.4	$606.6	6,141	2,878	2,972	11,991
Total	**$1,214.5**	**$513.6**	**$343.1**	**$2,071.2**	**$430.5**	**$277.8**	**$217.8**	**$926.1**	**13,106**	**4,437**	**4,196**	**21,739**

As indicated by Table J.18, the region will gain an annual average of 16,600 jobs if the public-sector funded infrastructure projects recommended in the 2001 RTP are adopted and implemented. Private sector funded projects would add an average of 12,000 jobs annually. The IMPLAN model only estimates employment impacts during the construction phases of these projects. The analysis does not include possible significant negative impacts to the region's commuters, truck drivers and businesses, etc. who have to pay tolls to use these facilities. However, the negative impacts from paying tolls will be partially offset by better mobility. It is expected that air quality improvements and reductions in vehicle hours traveled will also have net positive employment impacts on the SCAG region. The positive job impacts will be partially offset by the negative job impacts resulting from taxes and fees, accidents, and vehicle miles traveled. Nevertheless, the net overall job impact will be positive (+21,739 jobs).

The baseline forecast indicates that the region will add 106,500 jobs or 1.53% annually during the forecast period. The employment impacts from public sector funded projects account for 16% of total annual average job growth. Employment impacts from private sector funded projects will boost the region's annual average job growth rate by 11% (to 1.7% per year) under the current forecast.

Overall, the 2001 RTP will result in a $2.1 billion annual increase in total output (direct, indirect and induced) and a $0.9 billion annual increase in total value added (direct, indirect and induced). The large positive impacts generated by public and private investment are partially offset by the negative economic impacts resulting from taxes and fees and accidents.

Additional Performance Measures

The 2001 RTP performance in the areas of Environment (Air Quality) and Equity/Environmental Justice are discussed in separate appendices: Appendix H – Transportation Conformity Report, and Appendix I – Environmental Justice.

Future Outlook of Performance Measures

There is a general tendency to broaden the scope of alternative evaluations in assessing transportation choices, whether in the context of corridor improvement or area wide improvement strategies, to include all possible mode choices and all possible route choices. It is reasonable to expect that this trend will continue into the foreseeable future. Furthermore, there is also a general tendency to expand the scope of investigation itself insofar as analyzing various factors related directly or indirectly to the alternatives. Such comprehensive exercises would typically require evaluation of numerous alternatives economically and efficiently to narrow down the alternatives to a reasonable and manageable number for further intensive evaluation. Traditional alternative evaluation processes utilizing the EIR/EIS type of approach would be too expensive and cumbersome to accomplish such objectives required by the new planning processes and trends. The use of performance indicators is the only approach available at this time to accomplish such a mission. As such, the role of performance evaluation can be expected to be all the more important in the future of Transportation Planning.

Application of performance evaluation is still in its infant stage. Only the largest transportation agencies in the nation have begun to explore and develop performance measures and their applications. As performance evaluation becomes more common and the norm in transportation planning, more innovative and exciting applications and methodologies will emerge.